CITY OF DURHAM, NORTH CAROLINA

PROJECT MANUAL

INCLUDING

BIDDING DOCUMENTS, CONTRACT DOCUMENTS, AND TECHNICAL SPECIFICATIONS

FOR

DURHAM

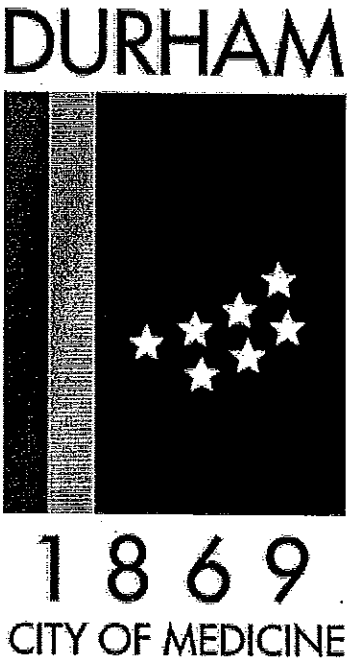
1869

CITY OF MEDICINE

Installation of Traffic Signals and Inductive Loops in Durham, NC

Transportation Division
Department of Transportation
101 City Hall Plaza
Durham, North Carolina 27701

Installation of Traffic Signals and Inductive Loops in Durham, NC



TRANSPORTATION DIVISION
DEPARTMENT OF TRANSPORTATION
CITY OF DURHAM, NORTH CAROLINA

CITY OF DURHAM
MAYOR AND CITY COUNCIL

William V. Bell, Mayor

Cora M. Cole-McFadden
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Howard Clement, III
J. Michael Woodard
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CITY OF DURHAM
STAFF

Thomas J. Bonfield, City Manager
Patrick W. Baker, City Attorney
D. Ann Gray, City Clerk
Mark D. Ahrendsen, Director of Transportation Department
Philip Loziuk, Transportation Engineer

CITY OF DURHAM NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

November 1, 2010

NOTICE TO PROSPECTIVE BIDDERS

SUBJECT: **Invitation to Bid on Purchase Order Contract**

DESCRIPTION: **Installation of Traffic Signals and Inductive Loops in Durham, NC**

The City of Durham Department of Transportation is requesting bids for the project described above. This project consists of the Installation of Traffic Signals and Inductive Loops in Durham, NC. This project shall conform to the North Carolina Department of Transportation Standard Specifications for Roads and Structures, July 2006 and any addendum.

The completion date is ~~the shorter of~~ 30 calendar days after delivery of mast arms or 8 months after receiving notice to proceed. The Contractor shall furnish all materials and equipment needed to install the traffic signal and saw cut inductive loops. Liquidated damages for this project are Five Hundred dollars ($500.00) per calendar day for failure to complete this project by the completion date.

*A **Non-Mandatory** Pre-bid meeting will be held in the Transportation Division 4th floor Conference room at 101 City Hall Plaza, Durham, NC 27701 at 2:00 P.M. on Wednesday, November 10, 2009.*

Sealed bids must be received in the Transportation Division, 4th floor at 101 City Hall Plaza, Durham, NC 27701 by 2:00 P.M. on Monday, November 22, 2010. Bids must be submitted and completed on the bid sheet included in the proposal and display the following statement on the front of the envelope:

"QUOTATION FOR INSTALLATION OF TRAFFIC SIGNALS AND INDUCTIVE LOOPS IN DURHAM, NC.

TO BE OPENED AT 2:00 PM, TUESDAY, NOVEMBER 22, 2010."

The City of Durham Department of Transportation, in accordance with the provisions of Title VI of the Civil Rights of 1964 (78 Stat.252) and the Regulations of the Department of Transportation (49 C.F.R., Part 21), issued pursuant to such act, hereby notifies all bidders that it will affirmatively insure that the contract entered into pursuant to this notice will be awarded to the lowest responsible bidder without discrimination on the grounds of sex, race, color or national origin.

If you have any questions or need additional information concerning this project, please contact me at (919) 560-4366.

Sincerely,

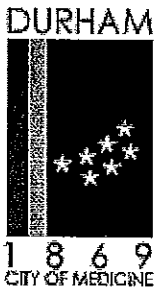
Pete Nicholas, P.E.
Traffic Operations Engineer

Attachments

cc: Mark Ahrendsen, Department of Transportation - Department Head, w/attachments

CITY OF DURHAM

TRANSPORTATION DEPARTMENT



CONTRACT PROPOSAL

PROJECT: Signal Installation
COUNTY: Durham
ROUTE: Signal Installations

- Broad Street at Perry Street
- Carver Street at Stadium Drive

Traffic Signal Inductive Loop Upgrades

- NC 54 at South Alston Avenue
- Guess Road at Horton Road
- Garret Road at Old Chapel Hill Road
- Miami Boulevard at Angier Avenue

DESCRIPTION: Installation of Traffic Signals and Inductive Loops in Durham, NC
BID OPENING: NOVEMBER 22, 2010

NOTICE:

ALL BIDDERS SHALL COMPLY WITH ALL APPLICABLE LAWS REGULATING THE PRACTICE OF GENERAL CONTRACTING AS CONTAINED IN CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA WHICH REQUIRES THE BIDDER TO BE LICENSED BY THE N.C. LICENSING BOARD FOR CONTRACTORS WHEN BIDDING ON ANY NON-FEDERAL AID PROJECT WHERE THE BID IS $50,000 OR MORE, EXCEPT FOR CERTAIN SPECIALTY WORK AS DETERMINED BY THE LICENSING BOARD OR SBE PROJECT. BIDDERS SHALL ALSO COMPLY WITH ALL OTHER APPLICABLE LAWS REGULATING THE PRACTICES OF ELECTRICAL CONTRACTING AS CONTAINED IN CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA.

ALS of North Carolina, Inc 18772-4
NAME OF BIDDER N.C. CONTRACTOR'S LICENSE NUMBER

Po Box 2949 Fayetteville, NC 28302
ADDRESS OF BIDDER

RETURN BIDS TO: City of Durham Transportation Division
Attention: Pete Nicholas, P.E.
101 City Hall Plaza
Durham, NC 27701

INSTRUCTIONS TO BIDDERS

PLEASE READ ALL INSTRUCTIONS CAREFULLY BEFORE PREPARING AND SUBMITTING YOUR BID.

All bids shall be prepared and submitted in accordance with the following requirements. Failure to comply with any requirement shall cause the bid to be considered irregular and shall be grounds for rejection of the bid.

1. The bid sheet furnished by Durham DOT with the proposal shall be used and shall not be altered in any manner. **DO NOT SEPARATE THE BID SHEET FROM THE PROPOSAL!**
2. All entries on the bid sheet, including signatures, shall be written in ink.
3. The Bidder shall submit a unit price for every item on the bid form. The unit prices for the various contract items shall be written in figures.
4. An amount bid shall be entered on the bid sheet for every item. The amount bid for each item shall be determined by multiplying each unit bid by the quantity for that item, and shall be written in figures in the "Amount Bid" column of the sheet.
5. The total amount bid shall be written in figures in the proper place on the bid sheet. The total amount shall be determined by adding the amounts bid for each item.
6. Changes in any entry shall be made by marking through the entry in ink and making the correct entry adjacent thereto in ink. A representative of the Bidder shall initial the change in ink.
7. The bid shall be properly executed. All bids shall show the following information:
   a. Name of individual, firm, corporation, partnership, or joint venture submitting bid.
   b. Name and signature of individual or representative submitting bid and position or title.
   c. Name, signature, and position or title of witness.
   d. Federal Identification Number (or Social Security Number of Individual)
   e. Contractor's License Number (if Applicable)
8. Bids submitted by corporations shall bear the seal of the corporation.
9. The bid shall not contain any unauthorized additions, deletions, or conditional bids.
10. The bidder shall not add any provision reserving the right to accept or reject an award, or to enter into a contract pursuant to an award.
11. **THE PROPOSAL WITH THE BID SHEET STILL ATTACHED SHALL BE PLACED IN A SEALED ENVELOPE AND SHALL HAVE BEEN DELIVERED TO AND RECEIVED IN THE CITY TRAFFIC ENGINEER'S OFFICE AT 101 CITY HALL PLAZA, DURHAM, NC 27701 BY 2:00 PM ON TUESDAY, NOVEMBER 22, 2010.**
12. The sealed bid must display the following statement on the front of the sealed envelope:

    "QUOTATION FOR INSTALLATION OF TRAFFIC SIGNALS AND INDUCTIVE LOOPS IN DURHAM, NC.

    TO BE OPENED AT 2:00 PM, TUESDAY, NOVEMBER 22, 2010."

13. If delivered by mail, the sealed envelope shall be placed in another sealed envelope and the outer envelope shall be addressed as follows:

    City of Durham Transportation Division
    Attention: Pete Nicholas, P.E.
    101 City Hall Plaza
    Durham, NC 27701

AWARD OF CONTRACT

The award of the contract, if it be awarded, will be made to the lowest responsible Bidder in accordance with Section 102 *(excluding 102-2 and 102-11)* of the Standard Specifications for Roads and Structures 2006. The lowest responsible bidder will be notified that his bid has been accepted and that he has been awarded the contract. City of Durham reserves the right to reject all bids.

CONTENTS

Appendices

PURCHASE ORDER CONTRACT

Standard Provisions

GENERAL

This contract is for the following traffic signal installations;

- **Broad Street at Perry Street**
- **Carver Street at Stadium Drive**

and traffic signal inductive loop upgrades at the following traffic signals;

- **NC 54 at South Alston Avenue**
- **Guess Road at Horton Road**
- **Garret Road at Old Chapel Hill Road**
- **Miami Boulevard at Angier Avenue**

All work and materials shall be in accordance with the provisions of the General Guidelines of this contract, the Project Special Provisions, the 2006 North Carolina Department of Transportation Standard Specifications for Roads and Structures, the 2006 North Carolina Department of Transportation Roadway Standards Drawings, and the current edition of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor will furnish all equipment and material necessary to complete this project. In the event of a conflict in any manner with the General Provisions, the General Provisions will prevail.

The Contractor shall keep himself fully informed of all Federal, State and local laws, ordinances, and regulations, and shall comply with the provisions of Section 107 of the Standard Specifications.

CONTRACT TIME AND LIQUIDATED DAMAGES

The date of availability for this project is TBD. The Contractor may begin work prior to this date upon approval of the Engineer or his duly authorized representative. If such approval is given, and the Contractor begins work prior to the date of availability, the City of Durham Transportation Division will assume no responsibility for any delays caused prior to the date of availability by any reason whatsoever, and such delays, if any, will not constitute a valid reason for extending the completion date.

No work will be permitted and no purchase order will be issued until all required SDBE, bonds (if applicable), prerequisite conditions and certifications have been satisfied.

The Contractor shall submit his bid for the completed construction of a traffic signal and inductive loops. The initial contract will cover work identified on the attached documentation plans. This work will begin on the date of the notice to proceed. The completion date is 30 calendar days after delivery of mast arms or 8 months after receiving notice to proceed.

Liquidated damages for this contract are Five Hundred dollars ($500.00) per calendar day, and will be charged for each calendar day, beyond the proposed limits, and will be reimbursed 100% to the City of Durham.

AUTHORITY OF THE ENGINEER

The Engineer for this project shall be the City of Durham's Traffic Engineer, acting directly or through his duly authorized representatives.

The Engineer will decide all questions that may arise as to the quality and acceptability of work performed and as to the rate of progress of the work; all questions that may arise as to the interpretation of the contract; and all questions as to the acceptable fulfillment of the contract on the part of the Contractor. The Engineer's decision shall be final and he shall have executive authority to enforce and make effective such decisions.

CLAIMS FOR ADDITIONAL COMPENSATION OR EXTENSION OF TIME

Any claims for additional compensation and/or extensions of the completion date shall be submitted to the City of Durham Traffic Engineer with detailed justification within thirty (30) days after receipt of the final invoice payment. The failure of the Contractor to submit the claim(s) within thirty days shall be a bar to recovery.

DEFAULT OF CONTRACT

The Department of Transportation shall have the right to declare default of contract for breach by the Contractor of any material term or condition of the contract. Default of contract shall be in accordance with the terms, conditions, and procedures of Article 108-9 of the Standard Specifications.

EXTENSION OF CONTRACT TIME

Failure on the part of the Contractor to furnish bonds, or certifications or to satisfy preliminary requirements necessary to issue the purchase order will not constitute grounds for extension of the contract time. If the Contractor has fulfilled all preliminary requirements for the issuance of a purchase order, and the purchase order authorization is not available by the date of availability, the Contractor shall be granted an extension equal to the number of calendar days the purchase order authorization is delayed after the date of availability.

INSPECTION

All work shall be subject to inspection by the Engineer at any time. Routinely, the Engineer will make periodic inspections of the completed work. It will be the responsibility of the Contractor to keep the Engineer informed of his proposed work plan and to submit written reports of work accomplished on a frequency to be determined by the Engineer.

LIABILITY INSURANCE

The Contractor shall obtain from an insurance company, duly authorized to do business in North Carolina, Public Liability and Property Damage Insurance to protect his company and subcontractors performing work covered under this contract from claims, which may arise from operations under this contract. Insurance coverage shall be maintained during the life of this contract and shall extend to operations performed by the Contractor or his subcontractors, and by anyone employed directly or indirectly by either of them.

Contractor shall maintain insurance not less than the following:

Commercial General Liability, Covering

- Premises/operations
- Products/completed operations
- Broad form property damage
- Explosion, collapse, and underground hazards if the hazards exist in the performance of this contract
- Contractual liability
- Independent contractors, if any are used in the performance of this contract
- City of Durham must be named additional insured, and an original of the endorsement to effect the coverage must be attached to the certificate (if by blanket endorsement, then agent may so indicate in the GL section of the certificate, in lieu of an original endorsement)
- Combined single limit not less than $3,000,000 per occurrence; products/completed operations shall not be less than $3,000,000 per occurrence

Automobile Liability Insurance, Covering

- Owned, hired, or borrowed vehicles
- Employee vehicles, if used in performance of this contract
- combined single limit not less than $3,000,000 per occurrence

Workers' Compensation Insurance, Covering

- Statutory benefits
- Covering employees; owners, partners, officers, and relatives (who work on this contract)
- Employers' liability, $1,000,000.

Insurance Shall Be Provided By

- Companies authorized to do business in the State of North Carolina
- Companies with Best rating of A or better.

Insurance Shall Be Evidenced By a Certificate

- Providing notice to the City of not less than 30 days prior to cancellation or reduction of coverage
- Certificates shall be addressed to:
  City of Durham, North Carolina
  Attention: Pete Nicholas
  101 City Hall Plaza

4th Floor Transportation
Durham, NC 27701

- The insurance certificate and the additional insured endorsement must be originals and must be approved by the City's Finance Director before Contractor can begin any work under this contract.

Proof of insurance shall be furnished to the Engineer prior to beginning work.

MATERIALS AND TESTING

The Engineer reserves the right to perform all sampling and testing in accordance with Section 106 of the Standard Specifications and the Department's "Materials and Test Manual." However the Engineer may reduce the frequency of sampling and testing where he deems it appropriate for the project under construction.

The Contractor shall furnish the applicable certifications and documentation for all materials as required by the Standard Specifications. Material, which is not properly certified, will not be accepted.

PAYMENT AND RETAINAGE

The Contractor may submit a request for partial payment on a monthly basis, or other interval as approved by the Engineer. Compensation for all pay items shall be in accordance with the Standard Specifications. The amount of partial payments will be based on the work accomplished and accepted as the last day of the approved pay period.

All requests for payment shall be made by Contractor's invoice, the invoice shall be submitted to:

City of Durham Transportation Division
Attention: Pete Nicholas P.E.
101 City Hall Plaza
Durham, NC 27701

All invoice items and unit costs shall correspond to contract pay items. In the event of error or discrepancy in items or unit costs, the Department may return the invoice to the contractor for correction.

An amount equal to five percent (5%) of the total amount due on the partial pay estimate will be deducted and retained until after the final inspection. One hundred percent (100%) payment shall be made after successful completion of the work as verified by the final inspection.

SUPERVISION BY CONTRACTOR

At all times during the life of the project the Contractor shall provide one permanent employee who shall have the authority and capability for overall responsibility of the project and who shall be personally available at the work site within 24 hours notice. Such employee shall be fully authorized to conduct all business with the subcontractors, to negotiate and execute all supplemental agreements, and to execute the orders or directions of the Engineer.

At all times that work is actually being performed, the Contractor shall have present on the project one competent individual who is authorized to act in a supervisory capacity over all work on the project, including work subcontracted. The individual who has been so authorized shall be experienced in the type of work being performed and shall be fully capable of managing, directing, and coordinating the work; of reading and thoroughly understanding the contract; and receiving and carrying out directions from the Engineer or his authorized representatives. He shall be an employee of the Contractor unless otherwise approved by the Engineer.

The Contractor may, at his option, designate one employee to meet the requirements of both positions. However, whenever the designated employee is absent from the work site, an authorized individual qualified to act in a supervisory capacity on the project shall be present.

SAFETY AND ACCIDENT PROTECTION

In accordance with Article 107-22 of the Standard Specifications, the Contractor shall comply with all applicable Federal, State, and local laws, ordinances, and regulations governing safety, health, and sanitation, and shall provide all safeguards, safety devices, and protective equipment, and shall take any other needed actions, on his own responsibility that are reasonably necessary to protect the life and health of employees on the job and the safety of the public, and to protect property in connection with the performance of the work covered by the contract.

SUBLETTING OF CONTRACT

The Contractor shall not sublet, sell, transfer, assign or otherwise dispose of this contract or any portion thereof; or his rights, title, or interest therein; without written consent of the Engineer. Subletting of this contract or any portion of the contract shall conform to the requirements of Article of 108-6 of the Standard Specifications.

TEMPORARY SUSPENSION OF WORK

In accordance with Article 108-7 of the Standard Specifications, the Engineer will have the authority to suspend the work wholly or in part, any written order for such periods as he may deem necessary for any of the following reasons.

1. Conditions considered unfavorable for the suitable prosecution of the work, or

2. The Contractor's failure for correct conditions unsafe for workmen or the general public, or

3. The Contractor has not carried out orders given to him by the Engineer, or

4. The Contractor's failure to perform any provisions of the contract.

No extension of the completion date will be allowed for the above suspensions except as may be provided for in Article 108-10.

TRAFFIC CONTROL AND WORK ZONE SAFETY

The Contractor shall provide for the safe and continuous maintenance of vehicular and pedestrian traffic through the area affected by the work, and is intended to minimize inconveniences to the traveling public, while providing for the safety of the motorists, pedestrians and workers

Work shall be as specified in the Contract Documents or as directed by the Engineer. The Contractor shall maintain traffic during construction and provide, install, and maintain all traffic control devices in accordance with these project guidelines, the Project Special Provisions, The Plans, North Carolina Department of Transportation Standard Specifications for Roads and Structures, and the current edition of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall utilize complete and proper traffic controls and traffic control devices during all operations. All traffic control and traffic control devices required for any operation shall be functional and in place prior to the commencement of that operation. Signs for temporary operations shall be removed during periods of inactivity. The Contractor is required to leave the project in a manner that will be safe to the traveling public and which will not impede motorists and pedestrians. Items used for temporary control of traffic shall be removed from the project site when no longer needed and become the property of the Contractor, unless otherwise specified in the contract documents.

Traffic movements through lane closures on roads with two-way traffic shall be controlled by flaggers stationed at each end of the work zone. In situations where sight distance is limited, the Contractor shall provide additional means of controlling traffic, including, but not limited to, two-way radios, pilot vehicles, or additional flaggers. Flaggers shall be competent personnel, adequately trained in flagging procedures, and furnished with proper safety devices and equipment, including, but not limited to, safety vests and stop/slow paddles.

All personnel when working in traffic areas or areas in close proximity to traffic shall wear an approved safety vest, or shirt or jacket which meets the color requirements of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall comply with all applicable Federal, State, and local laws, ordinances, and regulations governing safety, health, and sanitation, and shall provide all safeguards, safety devices, and protective equipment, and shall take any other needed actions, on their own responsibility that are reasonably necessary to protect the life and health of employees on the job and the safety of the public, and to protect property in connection with the performance of the work covered by the contract.

Failure to comply with any of the requirements for safety and traffic control of this contract shall result in suspension of work as provided in subarticle 108-7(2) of the Standard Specifications.

No direct payment shall be made for traffic control and work zone safety items, as they shall be considered incidental to other contract items.

UTILITY CONFLICTS

It shall be the responsibility of the Contractor to contact all affected utility owners and determine the precise locations of all utilities prior to beginning construction. Utility owners shall be contacted a minimum of 48 hours prior to the commencement of operations. Special care shall be used in working around or near existing utilities, protecting them when necessary to provide

uninterrupted service. In the event that any utility service is interrupted, the Contractor shall notify the utility owner immediately and shall cooperate with the owner, or his representative, in the restoration of service in the shortest time possible. Existing fire hydrants shall be kept accessible to fire departments at all times.

The Contractor shall adhere to all applicable regulations and follow accepted safety procedures when working in the vicinity of utilities in order to insure the safety of construction personnel and the public.

IDENTIFYING AND TAGGING OF CONTROLLER CABINET WIRING

All loop and lead-in cable installed in junction boxes and/or the controller cabinet shall be identified and tagged.

No direct payment will be made for the required identifying and tagging of these cables as it will be considered incidental to work being paid for by the various cable installation items of the contract.

PURCHASE ORDER CONTRACT
Special Provisions

PROSECUTION AND PROGRESS

The Contractor shall prepare and submit to the Engineer a proposed schedule of operations prior to beginning work on this project. The schedule should indicate the proposed chronological sequence of operations and may be revised within the limits of the contract with the approval of the Engineer.

The Contractor's operations are restricted to daylight hours and no work may be performed on Sundays and holidays unless otherwise approved by the Engineer. Work shall only be performed when weather and visibility conditions allow safe operations. The Contractor shall not close lanes or restrict traffic between the hours of 6:00 to 9:00 a.m. and 4:00 to 7:00 p.m. on weekdays.

The Contractor's vehicles and equipment shall not be parked within the State Highway System right of way overnight or at other times when work has been suspended unless approved by the Engineer, and in no case within 30 feet of the edge of pavement. The Engineer may designate specific locations for parking equipment.

TRAFFIC SIGNAL CONSTRUCTION:
DESCRIPTION - GENERAL:

The work covered by this special provision consists of installing a traffic signal with mast arms and installing inductive loops as shown on the attached plans. The contractor is to install the traffic signal cabinet, controller, metal poles, pedestrian and vehicular signal heads, meter service, loops, loop lead-in cable, conduits, signal cable and related hardware as required, in order to construct an operational traffic signal.

The contractor shall conform to the plans, the 2006 N. C. Department of Transportation's Standard Specifications for Roads and Structures, and the 2006 N. C. Department of Transportation's Roadway Standard Drawings, the project special provisions and local codes.

Copies of these publications may be obtained by writing or calling:

N. C. Department of Transportation
Design Services Unit-Manual Distribution
P.O. Box 25201
Raleigh, NC 27611
Phone (919) 250-4128

CONTRACTOR'S LICENSE REQUIREMENTS GENERAL:

The contractor shall be required to hold the proper license to perform the electrical work of this contract, in accordance with article 4 of Chapter 87 of the General Statutes (Licensing of Electrical Contractors).

ELECTRICAL REQUIREMENTS GENERAL:

The contractor shall have prior traffic signal construction experience, which will enable them to properly install the traffic signal with limited supervision.

All contractor supplied electrical materials and all work performed on the project shall meet the latest requirements of the national electrical code and all applicable local ordinances. The contractor shall comply with all applicable local ordinances and regulations prior to beginning any electrical work. He shall obtain all permits and licenses required by state and local agencies having jurisdiction over same. After completion of work, he shall have all work inspected.

CONSTRUCTION METHODS GENERAL:

DESCRIPTION:

The work covered in this provision consists of installing contractor furnished cabinet and controller, mast arm poles, signal heads, pedestrian signal heads, pedestals, junction boxes, meter service, loop wire, loop lead-in cable, signal cable and all related hardware.

Method of measurement and basis of payment for work performed by the Contractor will conform to the 2006 N. C. Department of Transportation Standard Specifications for Roads and Structures Section 1700.

The contractor shall be responsible for any/all damage to private and/or public property resulting from this work. The City of Durham assumes no liability regarding injury and/or property damage resulting from work performed by the contractor.

A. Notifying Utility Agencies:

The contractor shall be responsible for contacting all utility agencies for the purpose of locating all underground utilities, which might conflict with this work prior to beginning work. The contractor shall be responsible for any and all damages to utilities resulting from work performed by the contractor.

B. Distance From Utilities:

The contractor shall maintain minimum clearances from existing utilities having jurisdiction over same with the project limits. The actual elevations of the bottom of the signal heads are to conform to the requirements of the "NCDOT Traffic Signal Specification" or as prescribed by the Engineer or inspector.

C. Traffic Control During Construction:

The contractor shall maintain traffic through the work site in accordance with the current edition of the Manual of the Uniform Traffic Control Devices for Street and Highway, and the Standard Specifications for Roads and Structures.

The contractor shall furnish and place all warning and directional signs and other traffic control devices required to direct, control and protect the traveling public while construction is in process.

All required traffic control devices shall be in place prior to beginning any work and shall be removed daily when no longer needed.

No direct payment for signing and traffic control items will be made, as it shall be considered incidental to the contract.

D. Signal Heads:

Where feasible all vehicular signal heads should be installed at seventeen feet (17') to nineteen feet (19') above the roadway, measured from the bottom of the head, or directed by the engineer.

All electrical connections shall be made in each signal head on a terminal strip. Each signal head will have a proper drip loop.

E. Timing of The Traffic Signal(s):

The City of Durham Transportation Division shall be responsible for programming and timing of the traffic signal. Arrangements shall be made for delivery and acceptance of complete signal cabinet for setup and programming with the City of Durham Signal shop.

F. Conformity With The Provisions Of This Contract:

The presence of the Engineer or an inspector at the work site shall in no way lessen the Contractor's responsibility for conformity with the provisions of this contract. Should the Engineer or inspector fail to point out work that does not conform to the plans and specifications, whether from lack of discovery or for any other reason, it shall in no way prevent later rejection or correction to the unsatisfactory work when discovered. The contractor shall have no claim for losses suffered due to any necessary removals or repairs resulting from unsatisfactory work.

G. Site Clean-up:

The contractor shall clean the site of excess excavation, waste packing materials, wire and all other debris which result from installing the traffic signals and inductive loop detectors. At the end of each work day, the site shall be cleaned and cleared. The contractor will haul away any waste material to an approved public landfill.

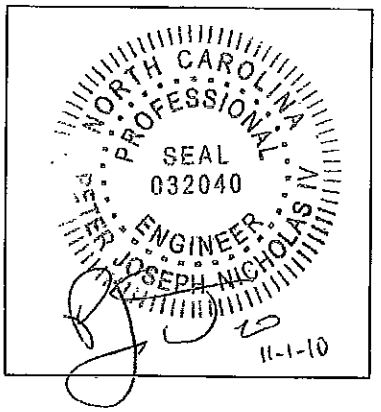
H. 30-Day Observation Period:

Upon completion of installing the signal installation and loop detectors as defined in the plans and special provisions for the project and after the signal installation has been approved, inspected, the 30-day observation period shall begin.

The purpose of this observation period is to assess the adequacy of the installation and operation of the installation, completion and final acceptance of the inductive loop detector system shall be contingent upon successful completion of the observation period.

I. Excavated Areas:

All excavated or otherwise damaged areas shall be repaired by shaping, smoothing, seeding and mulching, unless otherwise called out in this contract to be landscaped in a specific manner.



Project Special Provisions
(Version 06.6)
Signals and Intelligent Transportation Systems

Prepared By: JN
1-Nov-10

Contents

1. 2006 STANDARD SPECIFICATIONS FOR ROADS & STRUCTURES

The 2006 Standard Specifications are revised as follows:

1.1. General Requirements (1098-1)

Page 10-268, Subarticle 1098-1(H)

In the first paragraph, revise the second sentence to "Ensure service disconnects are listed as meeting UL Standard UL-489 and marked as being suitable for use as service equipment."

In the second paragraph, revise the first sentence to "Furnish NEMA Type 3R meter base rated 100 Ampere minimum that meets the requirements of the local utility. Provide meter base with sockets' ampere rating based on sockets being wired with minimum of 167 degrees F insulated wire."

In the second paragraph, last item on page, revise to "With or without horn bypass."

Page 10-269, Subarticle 1098-1(H)

Revise the second line to "Listed as meeting UL Standard UL-414."

In the first full paragraph on page, remove the first sentence.

Revise the last paragraph to "If meter base and electrical service disconnect are supplied in the same enclosure, ensure assembly is marked as being suitable for use as service equipment. Ensure combination meter and disconnect mounted in a pedestal for underground service is listed as meeting UL Standard UL-231. Otherwise, ensure combination meter and disconnect is listed as meeting UL Standard UL-67.

Page 10-269, Subarticle 1098-1 (J)

ADD new Subarticle 1098-1 (J) **Performance of Warranty Repair and Maintenance**

Provide authorization to the Traffic Electronics Center of the North Carolina Department of Transportation (NCDOT) to perform all warranty repairs after project acceptance. The decision to perform warranty work at the Traffic Electronics Center by NCDOT electronics technicians or to have warranty work performed by the vendor shall be at the discretion of the State. Provide any training required by the manufacturer to authorize the Traffic Electronics Center to perform warranty work and ensure manufacturer will furnish parts to the Traffic Electronics Center for all warranty repairs at no cost to the State. In addition, ensure the manufacturer agrees to provide prompt technical support to the NCDOT electronics technicians for a period of one year after the end of the warranty period at no cost to the State. Defective parts replaced under warranty by the Traffic Electronics Center will be returned to the vendor at the vendor's request. Provide schematics, part lists, and other documentation to perform bench repair to the Traffic Electronics Center within two weeks upon request. The Department agrees not to divulge any proprietary information in the schematics, part lists, and other documentation upon request from the vendor. After project acceptance and at the request of the State, manufacturer shall perform warranty repairs to equipment which fails during the warranty period at no cost to the State including freight costs to ship repaired equipment back to the Traffic Electronics Center. Ensure all equipment is repaired and returned to the Traffic Electronics Center within twenty-one calendar days of receipt by the manufacturer.

Page 10-269, Subarticle 1098-1 (K)

ADD new Subarticle 1098-1 (K) **Maintenance and Repair of Materials**

Perform maintenance (testing) on all Traffic Signal Conflict Monitors every twelve (12) months for the life of the project beginning with the initial test and every twelve (12) months thereafter. Provide the initial test date via the manufacturer's certification or via testing prior to installation of

the conflict monitor at an intersection. Use the ATSI Incorporated Model PCMT-2600 Conflict Monitor Tester, or an Engineer approved equivalent. Ensure that the Conflict Monitor Tester is maintained and calibrated per the manufacturer's recommendation. Provide to the Engineer a copy of the manufacturer's certification that the Conflict Monitor Tester is in proper working order before testing the Traffic Signal Conflict Monitors. Perform the test on the Traffic Signal Conflict Monitors per the manufacturer's recommendation. For each Traffic Signal Conflict Monitor tested, provide two (2) dated copies of the test results: one (1) copy for the Engineer and one (1) copy for the traffic signal cabinet.

1.2. Wood Poles (1098-6)

Page 10-272, Delete article. Refer to Subarticles 1082 –3(F) and 1082-4(G).

1.3. Loop Lead-in Cable (1098-8)

Page 10-274, Delete article and replace with the following:

Furnish lead-in cable with two conductors of number 14 AWG fabricated from stranded tinned copper that complies with IMSA Specification 50-2 except as follows:

Ensure conductor is twisted with a maximum lay of 2.0 inches, resulting in a minimum of 6 turns per foot.

Provide a ripcord to allow cable jacket to be opened without using a cutter.

Provide length markings in a contrasting color showing sequential feet and within one percent of actual cable length. Ensure character height of the markings is approximately 0.10 inch.

1.4. Underground Conduit – Construction Methods (1715-3)

Page 17-10, Subarticle 1715-3(B) Section (1), Revise 1st paragraph, 2nd sentence to:

Install rigid metallic conduit for all underground runs located inside railroad right-of-way.

1.5.Riser Assemblies – Construction Methods (1722-3)

Page 17-18, Subarticle 1722-3, Add the following:

Transition from the rigid galvanized steel risers to underground PVC conduits using an approved rigid galvanized steel sweeping elbow with PVC female adaptor.

1.6. Inductive Detection Loops – Construction Methods (1725-3)

Page 17-20, Subarticle 1725-3, In the first paragraph, revise the first sentence to:

"Between where loop conductor pairs leave saw cut in pavement and junction boxes, twist loop conductor pairs a minimum of 5 turns per foot."

1.7. Loop Lead-in Cable – Measurement and Payment (1726-4)

Page 17-20, Delete first paragraph and replace with the following:

Lead-in cable will be measured and paid as the actual linear feet of lead-in cable furnished, installed, and accepted. Measurement will be made by calculating the difference in length markings located on outer jacket from start of run to end of run for each run. Terminate all cables before determining length of cable run.

2. ELECTRICAL REQUIREMENTS

Ensure that an IMSA certified, or equivalent, Level II traffic qualified signal technician is standing by to provide emergency maintenance services whenever work is being performed on

traffic signal controller cabinets and traffic signal controller cabinet foundations. Stand by status is defined as being able to arrive, fully equipped, at the work site within 30 minutes ready to provide maintenance services.

3. SIGNAL HEADS

3.1. MATERIALS

A. General:

Fabricate vehicle signal head housings and end caps from die-cast aluminum. Fabricate 12-inch and 16-inch pedestrian signal head housings and end caps from die-cast aluminum. Fabricate 9-inch pedestrian signal head housings, end caps, and visors from virgin polycarbonate material. Provide visor mounting screws, door latches, and hinge pins fabricated from stainless steel. Provide interior screws, fasteners, and metal parts fabricated from stainless steel or corrosion resistant material.

Fabricate tunnel and traditional visors from sheet aluminum.

Paint all surfaces inside and outside of signal housings and doors. Paint outside surfaces of tunnel and traditional visors, messenger cable mounting assemblies, pole and pedestal mounting assemblies, and pedestrian pushbutton housings. Have electrostatically-applied, fused-polyester paint in highway yellow (Federal Standard 595A, Color Chip Number 13538) a minimum of 2.5 to 3.5 mils thick. Do not apply paint to the latching hardware or rigid vehicle signal head mounting brackets for mast-arm attachments.

Have the interior surfaces of tunnel and traditional visors painted an alkyd urea black synthetic baking enamel with a minimum gloss reflectance and meeting the requirements of MIL-E-10169, "Enamel Heat Resisting, Instrument Black."

For pole mounting, provide side of pole mounting assemblies with framework and all other hardware necessary to make complete, watertight connections of the signal heads to the poles and pedestals. Fabricate the mounting assemblies and frames from aluminum with all necessary hardware, screws, washers, etc. to be stainless steel. Provide mounting fittings that match the positive locking device on the signal head with the serrations integrally cast into the brackets. Provide upper and lower pole plates that have a 1 ¼-inch vertical conduit entrance hubs with the hubs capped on the lower plate and 1 ½-inch horizontal hubs. Ensure that the assemblies provide rigid attachments to poles and pedestals so as to allow no twisting or swaying of the signal heads. Ensure that all raceways are free of sharp edges and protrusions, and can accommodate a minimum of ten Number 14 AWG conductors.

For pedestal mounting, provide a post-top slipfitter mounting assembly that matches the positive locking device on the signal head with serrations integrally cast into the slipfitter. Provide stainless steel hardware, screws, washers, etc. Provide a minimum of six 3/8 X 3/4-inch long square head bolts for attachment to pedestal. Provide a center post for multi-way slipfitters.

For light emitting diode (LED) traffic signal modules, provide the following requirements for inclusion on the Department's Qualified Products List for traffic signal equipment.

1. Sample submittal,
2. Third-party independent laboratory testing results for each submitted module with evidence of testing and conformance with all of the Design Qualification Testing specified in section 6.4 of each of the following Institute of Transportation Engineers (ITE) specifications:
   - Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement

- Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement
- Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules.

(Note: The Department currently recognizes two approved independent testing laboratories. They are Intertek ETL Semko and Light Metrics, Incorporated with Garwood Laboratories. Independent laboratory tests from other laboratories may be considered as part of the QPL submittal at the discretion of the Department,

3. Evidence of conformance with the requirements of these specifications,
4. A manufacturer's warranty statement in accordance with the required warranty, and
5. Submittal of manufacturer's design and production documentation for the model, including but not limited to, electrical schematics, electronic component values, proprietary part numbers, bill of materials, and production electrical and photometric test parameters.

In addition to meeting the performance requirements for the minimum period of 60 months, provide a written warranty against defects in materials and workmanship for the modules for a period of 60 months after installation of the modules. During the warranty period, the manufacturer must provide replacement modules within 45 days of receipt of modules that have failed at no cost to the State. Provide manufacturer's warranty documentation to the Department during evaluation of product for inclusion on Qualified Products List (QPL).

B. Vehicle Signal Heads:

Comply with the ITE standard "Vehicle Traffic Control Signal Heads". Provide housings with provisions for attaching backplates.

Provide visors that are 8 inches in length for 8-inch vehicle signal head sections. Provide visors that are 10 inches in length for 12-inch vehicle signal heads.

Provide a termination block with one empty terminal for field wiring for each indication plus one empty terminal for the neutral conductor. Have all signal sections wired to the termination block. Provide barriers between the terminals that have terminal screws with a minimum Number 8 thread size and that will accommodate and secure spade lugs sized for a Number 10 terminal screw.

Mount termination blocks in the yellow signal head sections on all in-line vehicle signal heads. Mount the termination block in the red section on five-section vehicle signal heads.

Furnish vehicle signal head interconnecting brackets. Provide one-piece aluminum brackets less than 4.5 inches in height and with no threaded pipe connections. Provide hand holes on the bottom of the brackets to aid in installing wires to the signal heads. Lower brackets that carry no wires and are used only for connecting the bottom signal sections together may be flat in construction.

For messenger cable mounting, provide messenger cable hangers, wire outlet bodies, balance adjusters, bottom caps, wire entrance fitting brackets, and all other hardware necessary to make complete, watertight connections of the vehicle signal heads to the messenger cable. Fabricate mounting assemblies from malleable iron or steel and provide serrated rings made of aluminum. Provide messenger cable hangers and balance adjusters that are galvanized before being painted. Fabricate balance adjuster eyebolt and eyebolt nut from stainless steel or galvanized malleable iron. Provide messenger cable hangers with U-bolt clamps. Fabricate washers, screws, bolts, clevis pins, cotter pins, nuts, and U-bolt clamps from stainless steel.

For mast-arm mounting, provide rigid vehicle signal head mounting brackets and all other hardware necessary to make complete, watertight connections of the vehicle signal heads to the mast arms and to provide a means for vertically adjusting the vehicle signal heads to proper alignment.

Fabricate the mounting assemblies from malleable iron or aluminum, and provide serrated rings made of aluminum.

Provide LED vehicular traffic signal modules (hereafter referred to as modules) that consist of an assembly that uses LEDs as the light source in lieu of an incandescent lamp for use in traffic signal sections. Use LEDs that are aluminum indium gallium phosphorus (AlInGaP) technology for red and yellow indications and indium gallium nitride (InGaN) for green indications. Install the ultra bright type LEDs that are rated for 100,000 hours of continuous operation from -40°F to +165°F. Design modules to have a minimum useful life of 60 months and to meet all parameters of this specification during this period of useful life.

For the modules, provide spade terminals crimped to the lead wires and sized for a #10 screw connection to the existing terminal block in a standard signal head. Do not provide other types of crimped terminals with a spade adapter.

Ensure the power supply is integral to the module assembly. On the back of the module, permanently mark the date of manufacture (month & year) or some other method of identifying date of manufacture.

Tint the red, yellow and green lenses to correspond with the wavelength (chromaticity) of the LED. Transparent tinting films are unacceptable. Provide a lens that is integral to the unit with a smooth outer surface.

1. LED Circular Signal Modules:

Provide modules in the following configurations: 12-inch circular sections, and 8-inch circular sections. All makes and models of LED modules purchased for use on the State Highway System shall appear on the current NCDOT Traffic Signal Qualified Products List (QPL).

Provide the manufacturer's model number and the product number (assigned by the Department) for each module that appears on the 2006 or most recent Qualified Products List. In addition, provide manufacturer's certification in accordance with Article 106-3 of the *Standard Specifications,* that each module meets or exceeds the ITE "Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement" dated June 27, 2005 (hereafter referred to as VTCSH Circular Supplement) and other requirements stated in this specification.

Provide modules that meet the following requirements when tested under the procedures outlined in the VTCSH Circular Supplement:

Module Type	Max. Wattage at 165° F	Nominal Wattage at 77° F
12-inch red circular	17	11
8-inch red circular	13	8
12-inch green circular	15	15
8-inch green circular	12	12

For yellow circular signal modules, provide modules tested under the procedures outlined in the VTCSH Circular Supplement to insure power required at 77° F is 22 Watts or less for the 12-inch circular module and 13 Watts or less for the 8-inch circular module.

Note: Use a wattmeter having an accuracy of ±1% to measure the nominal wattage and maximum wattage of a circular traffic signal module. Power may also be derived from voltage, current and power factor measurements.

2. LED Arrow Signal Modules

Provide 12-inch omnidirectional arrow signal modules. All makes and models of LED modules purchased for use on the State Highway System shall appear on the current NCDOT Traffic Signal Qualified Products List (QPL).

Provide the manufacturer's model number and the product number (assigned by the Department) for each module that appears on the 2006 or most recent Qualified Products List. In addition, provide manufacturer's certification in accordance with Article 106-3 of the *Standard Specifications,* that each module meets or exceeds the requirements for 12-inch omnidirectional modules specified in the ITE "Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement" dated July 1, 2007 (hereafter referred to as VTCSH Arrow Supplement) and other requirements stated in this specification.

Provide modules that meet the following requirements when tested under the procedures outlined in the VTCSH Arrow Supplement:

Module Type	Max. Wattage at 165° F	Nominal Wattage at 77° F
12-inch red circular	12	9
12-inch green circular	11	11

For yellow arrow signal modules, provide modules tested under the procedures outlined in the VTCSH Arrow Supplement to insure power required at 77° F is 12 Watts or less.

Note: Use a wattmeter having an accuracy of ±1% to measure the nominal wattage and maximum wattage of an arrow traffic signal module. Power may also be derived from voltage, current and power factor measurements.

C. Pedestrian Signal Heads:

Provide pedestrian signal heads with international symbols that meet the MUTCD. Do not provide letter indications.

Comply with the ITE standard for "Pedestrian Traffic Control Signal Indications" and the following sections of the ITE standard for "Vehicle Traffic Control Signal Heads" in effect on the date of advertisement:

- Section 3.00 - "Physical and Mechanical Requirements"
- Section 4.01 - "Housing, Door, and Visor: General"
- Section 4.04 - "Housing, Door, and Visor: Materials and Fabrication"
- Section 7.00 - "Exterior Finish"

Provide a double-row termination block with three empty terminals and number 10 screws for field wiring. Provide barriers between the terminals that accommodate a spade lug sized for number 10 terminal screws. Mount the termination block in the hand section. Wire all signal sections to the terminal block.

Where required by the plans, provide 16-inch pedestrian signal heads with traditional three-sided, rectangular visors, 6 inches long. Where required by the plans, provide 12-inch pedestrian signal heads with traditional three-sided, rectangular visors, 8 inches long.

Design the LED pedestrian traffic signal modules (hereafter referred to as modules) for installation into standard pedestrian traffic signal sections that do not contain the incandescent signal section reflector, lens, eggcrate visor, gasket, or socket. Provide modules that consist of an assembly that uses LEDs as the light source in lieu of an incandescent lamp. Use LEDs that are of the latest aluminum indium gallium phosphorus (AlInGaP) technology for the Portland Orange hand and countdown displays. Use LEDs that are of the latest indium gallium nitride (InGaN) technology for

the Lunar White walking man displays. Install the ultra bright type LEDs that are rated for 100,000 hours of continuous operation from -40°F to +165°F. Design modules to have a minimum useful life of 60 months and to meet all parameters of this specification during this period of useful life.

Provide modules in the following configuration: 16-inch displays which have the solid hand/walking man overlay on the left and the countdown on the right, and 12-inch displays which have the solid hand/walking man module as an overlay. All makes and models of LED modules purchased for use on the State Highway System shall appear on the current NCDOT Traffic Signal Qualified Products List (QPL).

Provide the manufacturer's model number and the product number (assigned by the Department) for each module that appears on the 2006 or most recent Qualified Products List. In addition, provide manufacturer's certification in accordance with Article 106-3 of the *Standard Specifications,* that each module meets or exceeds the ITE "Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules" dated March 19, 2004 (hereafter referred to as PTCSI Pedestrian Standard) and other requirements stated in this specification.

Design all modules to operate using a standard 3 - wire field installation. Provide spade terminals crimped to the lead wires and sized for a #10 screw connection to the existing terminal block in a standard pedestrian signal housing. Do not provide other types of crimped terminals with a spade adapter.

Ensure the power supply is integral to the module assembly. On the back of the module, permanently mark the date of manufacture (month & year) or some other method of identifying date of manufacture.

Provide module lens that is hard coated or otherwise made to comply with the material exposure and weathering effects requirements of the Society of Automotive Engineers (SAE) J576. Ensure all exposed components of the module are suitable for prolonged exposure to the environment, without appreciable degradation that would interfere with function or appearance.

Design the walking man and hand as a solid display. Ensure the hand/walking man symbols for the 16-inch display module meet the dimension requirements cited in PTCSI Pedestrian Standard Table 1 "*Dimensions of Signal Sizes*" for Class 3 or Class 4. Ensure the hand/walking man symbols for the 12-inch display module meet the dimension requirements cited in PTCSI Pedestrian Standard Table 1 "*Dimensions of Signal Sizes*" for Class 2.

Provide the countdown number display that is at least 9 inches high by 6 inches wide. Ensure the minimum luminance value for the countdown number display is 1,400 cd/m^2. Provide the countdown number display that will conform to the chromaticity requirements of the hand symbol as specified by section 4.2 (Chromaticity) of the PTCSI Pedestrian Standard. Furnish the countdown display to continuously monitor the traffic controller to automatically learn the pedestrian phase time and update for subsequent changes to the pedestrian phase time. Design the countdown display as a double row of LEDs or with a minimum thickness of 0.5 inch. Ensure the countdown display blanks-out during the initial cycle while it records the countdown time. Ensure that the countdown display is operational only during the flashing don't walk, clearance interval. Blank-out the countdown indication after it reaches zero and until the beginning of the next flashing don't walk indication. Design the controlling circuitry to prevent the timer from being triggered during the solid hand indication.

Provide modules that meet the following requirements when tested under the procedures outlined in the PTCSI Pedestrian Standard:

Module Type	Max. Wattage at 165° F	Nominal Wattage at 77° F

Hand Indication	16	13
Walking Man Indication	12	9
Countdown Indication	16	13

Note: Use a wattmeter having an accuracy of ±1% to measure the nominal wattage and maximum wattage of a pedestrian signal module. Power may also be derived from voltage, current and power factor measurements.

Provide 2-inch diameter pedestrian push-buttons with weather-tight housings fabricated from die-cast aluminum and threading in compliance with the NEC for rigid metal conduit. Provide a weep hole in the housing bottom and ensure that the unit is vandal resistant.

Provide push-button housings that are suitable for mounting on flat or curved surfaces and that will accept 1/2-inch conduit installed in the top. Provide units that have a heavy duty push-button assembly with a sturdy, momentary, normally-open switch. Have contacts that are electrically insulated from the housing and push-button. Ensure that the push-buttons are rated for a minimum of 5 mA at 24 volts DC and 250 mA at 12 volts AC.

Provide standard R10-3 signs with mounting hardware that comply with the MUTCD in effect on the date of advertisement. Provide R10-3E signs for countdown pedestrian heads and R10-3B for non-countdown pedestrian heads.

D. Signal Cable:

Furnish 16-4 and 16-7 signal cable that complies with IMSA specification 20-1 except provide the following conductor insulation colors:

- For 16-4 cable: white, yellow, red, and green
- For 16-7 cable: white, yellow, red, green, yellow with black stripe tracer, red with black stripe tracer, and green with black stripe tracer. Apply continuous stripe tracer on conductor insulation with a longitudinal or spiral pattern.

Provide a ripcord to allow the cable jacket to be opened without using a cutter. IMSA specification 19-1 will not be acceptable. Provide a cable jacket labeled with the IMSA specification number and provide conductors constructed of stranded copper.

4. SPREAD SPECTRUM WIRELESS RADIO

4.1. DESCRIPTION

Furnish and install a spread spectrum wireless radio system with all necessary hardware and signage in accordance with the plans and specifications to provide a data link between field devices (i.e. Traffic Signal Controllers, Dynamic Message Signs, etc.). Provide a radio system with a bi-directional, full duplex communications channel between two "line-of-sight" antennas using license free, spread spectrum technology operating in the 902-928 MHz frequency band.

Furnish material and workmanship conforming to the *National Electrical Code* (NEC), the *National Electrical Safety Code* (NESC), Underwriter's Laboratories (UL) or a third-party listing agency accredited by the North Carolina Department of Insurance, and all local safety codes in effect on the date of advertisement. Comply with all regulations and codes imposed by the owner of affected utility poles.

4.2.MATERIALS

A. 900MHz Wireless Radio Systems:

Furnish license free 902 – 928 MHz radio modems with antennas, coaxial cable and mounting hardware, and configuration software. Design radio modems to work in "point-to-point", "point-to-multipoint", "multipoint-to-point", and "multipoint-to-multipoint" configurations. Ensure the spread spectrum wireless radio meets the following minimum requirements:

- License free (ISM) Spread Spectrum radio band (902 – 928 MHz)
- Frequency Hopping Technology (Direct Sequence Spread Spectrum Technology is not acceptable)
- Bi-Directional, Full Duplex
- Programmable Radio Frequency (RF) output levels of 1mW, 10mW, 100mW, or 1 Watt
- A minimum of 139 user-selectable radio frequency channels, with 62 available hopping sequences (2 non-overlapping)
- RS-232 interface capable of operating from 1200 bps to 115.2 Kbps, with 8 or 9 bit format or 1200 bps Bell 202 and supports FSK (2 or 4-wire) systems configurations (provide appropriate FSK module as needed when working with copper backbone systems)
- DB9-F connector for RS-232 port
- RJ 22 connector for FSK port
- Maximum of 8 mSec. end-to-end latency
- 16 bit Cyclic Redundancy Check (CRC) error checking with auto re-transmit
- Built-in store-and-forward (single radio repeater – back to back radio set-ups are not allowed to accomplish this function)
- 32 Bit encryption
- Receiver Sensitivity of –110dBm @ 10^-6 BER
- Antenna port: Reverse Polarity - Threaded Normalized Connector-Female (RP TNC-F) antenna connector
- Front panel LED indicators:
  - Power
  - Transmit Data
  - Receive Data
  - Data Port Indicator
- Operating temperature of –40 to +176 degrees F at 0 to 95% Humidity
- Power supply requirements:
  - Wall Adapter: 120 VAC UL/CSA wall cube plug-in module with 12 VDC, 1 Amp, nominal output.
  - Typical current draw of no greater than 355 mA when powered with 12 VDC input, and transmitting 1 Watt of RF output power.
  - Radio Sleep mode with a maximum current draw of <1μA.
- Shelf mounted design not to exceed 9" long x 2" wide x 5" high

Furnish a Radio Frequency Signal Jumper constructed of an RG-58 Coaxial Cable with Reverse Polarity - Threaded Normalized Connector-Male (RP TNC-M) on one end for connection to a radio unit and a Standard N-Type Male Connector on the other end for connection to the lightning arrestor. Provide the jumper in 6 foot lengths.

Furnish an RS-232 data interface cable to be installed between the radio modem and the field device's RS-232 interface. Ensure cable is a minimum of 6 feet long.

Ensure that installing the wireless radio system with a fully functional field device (i.e. controller) does not require any field device modifications with regards to hardware or software.

Furnish an ENCOM Model # EP-5100 Spread Spectrum Wireless Radio or an approved equivalent.

B. 900MHz Wireless Repeater Standalone Radio System:

B.1 General:

Furnish an operational 900MHz wireless repeater radio system installed in a NEMA Type 3R enclosure for pole mounting. As a minimum, ensure the 900Mhz Wireless repeater radio meets the specifications provided above.

B.2 Cabinet:

Furnish the cabinet shell constructed from unpainted, natural aluminum. Ensure that all non-aluminum hardware on the cabinet is stainless steel or an approved non-corrosive alternate. Ensure that each exterior cabinet plane surface is constructed of a single sheet of aluminum and is seamless. Provide continuous welds made from the inside wherever possible. On the exterior, provide joints that are smooth and flush. Ensure that no screws, bolts, or rivets protrude to the outside of the cabinet shell.

Ensure that all components are arranged for easy access during servicing.

Provide sufficient size so the installed equipment will not occupy more than 60 percent of the total cabinet volume.

Provide a handle and three point latching mechanism designed to be disassembled using hand tools. Provide a shaft connecting the latching plate to the door handle by passing through the door within a bushing, bearing, or equivalent device. Provide a latching plate at least 1/8 inch thick and that mates securely with the lock bolt. Provide a lock bolt with a flat end (no bevel) and that has at least 1/4 inch of length in contact with the latching plate.

Ensure that the handle and lock are positioned so that the lock does not lie in the path of the rotating handle as the door is unlatched and that the handle points down in the latched position.

Provide a main door opening that encompasses the full frontal area of the cabinet shell. Ensure that the cabinet shell is sturdy and does not exhibit noticeable flexing, bending or distortion under normal conditions, except that a minor amount of flexing is permitted in the main door when the cabinet is open. In such case, the flexing must not result in permanent deformation of the door.

A police panel door is not required for this cabinet.

Provide a roof with a slope from front to back at a minimum ratio of 1 inch drop per 2 feet. Ensure the cabinet is vented at the top and in the door. Supply a cabinet door assembly with a louvered air vent and standard-sized fiberglass air filter.

Provide one equipment shelf in the cabinet that extends the practical width of the cabinet. Ensure that the shelf can be moved up and down within the cabinet. Do not locate permanently mounted equipment in such a way that will restrict access to terminals.

B.3 Cabinet Electrical:

Furnish a cabinet with two 15 Amp, single pole circuit breakers for power distribution. Ensure one 15 Amp auxiliary breaker provides the electrical circuit to accommodate a thermostatically

controlled cabinet exhaust fan, door activated fluorescent light, and one GFCI convenience receptacle.

Ensure the second 15 Amp equipment breaker provides the electrical circuit to accommodate the electrical equipment installed in the cabinet with a minimum of two duplex receptacles.

Provide a two-stage power line surge protector between the electrical equipment receptacles and the 15 Amp equipment breaker. Ensure a maximum continuous current of at least 10A at 120V. Ensure that the device can withstand a minimum of 20 peak surge current occurrences at 20,000A for an 8x20 microsecond waveform. Provide a maximum clamp voltage of 280V at 20,000A with a nominal series inductance of 200μh. Ensure that the voltage does not exceed 280V. Provide devices that comply with the following:

Frequency (Hz)	Minimum Insertion Loss (dB)
60	0
10,000	30
50,000	55
100,000	50
500,000	50
2,000,000	60
5,000,000	40
10,000,000	20
20,000,000	25

Ensure the two-stage power line surge protector will allow connection of a radio frequency interference filter between the two stages of the device. Ensure the radio frequency interference filter minimizes interference generated in the cabinet in both the broadcast and aircraft frequencies. Ensure the filter(s) provide attenuation of at least 50 decibels over a frequency range of 200 kilohertz to 75 megahertz. Furnish a filter that is hermetically sealed in an insulated metal case. Ensure the filter is rated at least at the rated current of the main circuit breaker, 125-volts, 60Hz.

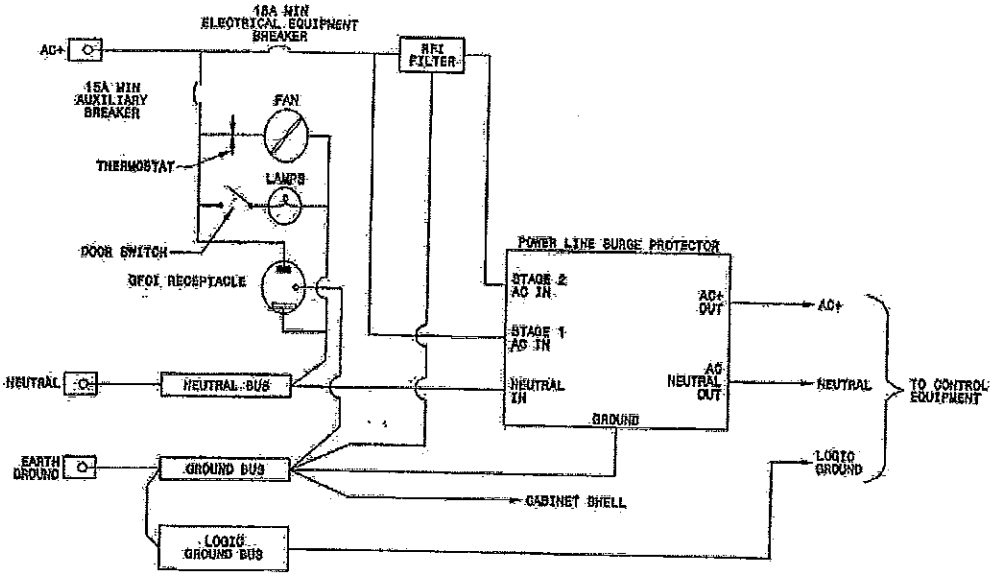
Furnish a fluorescent fixture with lamps mounted above the shelf to light the equipment area.

Fasten all wiring and harness supports to the cabinet with screws or other removable mechanical means. Do not use adhesives.

Do not locate terminals on the underside of the shelf or at other places where they are not readily visible and accessible, or where they may be a hazard to personnel. Provide a clear plastic guard for exposed 120-volt AC terminals on the power panel.

Provide a neutral that is not connected to the earth ground or the logic ground anywhere within the cabinet. Ensure that the earth ground bus and the neutral ground bus each have ten compression type terminals each of which can accommodate wires ranging from number 14 through number 4.

Furnish a cabinet wiring schematic to be placed in the cabinet. Reference the cabinet wiring schematic below for additional details:



C. Software:

Furnish units with a Window Based™ software program that uses a GUI (Graphical User Interface) to provide "remote programming, radio configuration, remote maintenance, diagnostics and spectrum analyzer" features. For compatibility with the ENCOM wireless radio or an approved equivalent wireless radio, provide ENCOM ControlPAK software or an approved equivalent software that is designed to function with the approved wireless radio. Provide configuration software that can be upgraded in the future at no additional charge.

Ensure the radio modem is configurable from a single location (i.e. master radio location) via supplied software (no extra cost). Furnish software supplied with drivers to allow easy set-up with all industry standard traffic signal controllers, including 2070 controllers containing custom software written specifically for the North Carolina Department of Transportation. Ensure the supplied software contains pre-written drivers for industry standard radar and video detection packages and Dynamic Message Sign controllers.

D. Directional Antenna (Yagi):

Furnish a directional antenna that will allow the system to function as designed. Furnish Cushcraft Model # PC906N (8.5 dB Gain) or Cushcraft Model # PC9013N (13 dB Gain) antenna or an approved equivalent antenna that meets the following minimum specifications:

Cushcraft Model # PC906N (8.5 dB Gain)

Frequency Range	896 – 940 MHz
Nominal Gain	8.5 dB
Front to Back Ratio	18 dB
Horizontal Beamwidth (at half power points)	65 degree
Vertical Beamwidth (at half power points)	55 degree
Power Rating, UHF Frequency	200 Watts
Lightning Protection	DC Ground
Termination	Coaxial pigtail with a Standard N-Type Female Connector
Impedance	50 ohms
Length	24"
Rated Wind Velocity	125 mph
Rated Wind Velocity (with 0.5 inch radial ice)	100 mph
Projected Wind Surface Area (flat plane equivalent)	0.26 ftsq.
Number Elements	6
Allows for Vertical or Horizontal polarization	
Minimum separation distance from persons installing and using an active device	9"
Minimum separation distance from other RF sources including radios and antennas	6.5'
Welded construction	

Cushcraft Model # PC9013N (13 dB Gain)

Frequency Range	902 – 928 MHz
Nominal Gain	13 dB
Front to Back Ratio	20 dB
Horizontal Beamwidth (at half power points)	40 degree
Vertical Beamwidth (at half power points)	35 degree
Power Rating, UHF Frequency	200 Watts
Lightning Protection	DC Ground
Termination	Coaxial pigtail with a Standard N-Type Female Connector
Impedance	50 ohms
Length	53"
Rated Wind Velocity	125 mph
Rated Wind Velocity (with 0.5 inch radial ice)	100 mph
Projected Wind Surface Area (flat plane equivalent)	0.46 ftsq.
Number Elements	13
Allows for Vertical or Horizontal polarization	
Minimum separation distance from persons installing and using an active device	9"
Minimum separation distance from other RF sources including radios and antennas	6.5'
Welded construction	

Furnish mounting hardware to secure the antenna to the metal pole or wood pole, as recommended by the manufacturer of the antenna and as approved by the Engineer.

E. Omni Directional Antenna:

Furnish an omni directional antenna that will allow the system to function as designed. Furnish 3dB Antenex Model # FG9023 or 6dB Antenex Model # FG9026 antenna or approved equivalent antennas that meet the following minimum specifications:

Frequency Range	902 – 928 MHz
Nominal Gain	Typical gains of 3 or 6 dB (dependent upon gain needed for application)
Termination	Standard N-Type Female Connector
Impedance	50 ohms
VSWR	1.5:1
Vertical Beam Width	3 dB – 33 degrees; 6 dB – 17 degrees
Lightening Protection	DC Ground
Power Rating, UHF Frequency	100 Watts
Length	3dB – 25" 6dB – 65"
Rated Wind Velocity	125 mph
Solid, single piece construction	
Minimum separation distance from persons installing and using an active device	9"
Minimum separation distance from other RF sources including radios and antennas	6.5'
Mount in a vertical direction and limit to vertically polarized RF systems	

Furnish mounting hardware to secure the antenna to the metal pole or wood pole, as recommended by the manufacturer of the antenna and as approved by the Engineer.

F. Coaxial Cable:

Furnish a Times Microwave Systems™ LMR 400 Cable or ANDREW CNT-400 Cinta™ Braided Cable, or equivalent antenna coaxial cable to provide a link between the antenna and the lightning arrestor that meets the following minimum specifications:

Attenuation (dB per 100 feet) @ 900 MHz	3.9 dB
Power Rating @ 900 Mhz	0.58 kW
Center Conductor	0.108" Copper Clad Aluminum
Dielectric: Cellular PE	0.285"
Shield	Aluminum Tape – 0.291" Tinned Copper Braid – 0.320"
Jacket	Black UV protected polyethylene
Bend Radius	1" with less than 1 ohm impedance change at bend
Impedance	50 ohms
Capacitance per foot	23.9 pf/ft
End Connectors	Standard N-Type Male Connectors on both ends

G. Standard N-Type Male Connector:

Furnish Standard N-Type Male Connector(s) of proper sizing to mate with the 400 series coaxial cable and utilize a crimping method to secure the connector to the coaxial cable. Furnish a connector that meets the following minimum specifications:

- Center Contact: Gold Plated Beryllium Copper-(spring loaded – Non-solder)

- Outer Contact: Silver Plated Brass
- Body: Silver Plated Brass
- Crimp Sleeve: Silver Plated Copper
- Dielectric: Teflon PTFE
- Water Proofing Sleeve: Adhesive Lined Polyolefin – Heat Shrink
- Attachment Size: Crimp Size 0.429" (minimum) hex

Electrical Properties:

- Impedance: 50 ohms
- Working Voltage: 1000 vrms (max)
- Insertion loss: 0.1 x $\sqrt{}$ Fghz
- VSWR: 1.25:1 (max) up to 3GHz

Provide instructions on properly installing the connector.

H. Coaxial Cable Shield Grounding and Weatherproofing Kits:

Furnish a Coaxial Cable Shield Grounding Kit containing components that will adequately bond and ground the cable shield to the pole ground. Ensure the grounding kit complies with MIL-STD-188-124A Specifications "Military Standard for Grounding, Bonding and Shielding" for coaxial cable and protects the cable from lightning currents in excess of 200kA. Ensure each kit is supplied, as a minimum, with the following:

- Preformed Strap: 24 Gauge copper strap that is a minimum of 1 5/8 inch long and is sized to mate with the 400 series coaxial cable
- Tensioning Hardware: Copper nuts and lock washers
- Grounding Lead Cable: #6 AWG, stranded, insulated copper wire
- Instructions on properly installing the shield grounding system

Furnish a Weatherproofing Kit containing components that will protect the coaxial cable shield grounding system against the ingress of moisture and prevent vibrations from loosening the connections. Ensure the weatherproofing kit is supplied, as a minimum, with the following:

- Butyl Mastic Tape: 3 3/4 inches wide by 24 inches long (approximately)
- Electrical Tape: 2 inch wide by 20 inches long (approximately)
- Instructions on properly installing the weatherproofing system

I. Lightning Arrestor:

Furnish a lightning arrestor installed in line between each antenna and its designated radio modem inside the equipment cabinet. Furnish a Polyphaser Model # DSXL lightning arrestor or an approved equivalent that meets the following minimum specifications:

- Surge: 20kA, 800MHz to 2.0GHz $\leq$ 1.1 : 1 VSWR
  18kA, 800MHz to 2.3GHz $\leq$ 1.1 : 1 VSWR
  700MHz to 2.7GHz $\leq$ 1.2 : 1 VSWR
- Insertion Loss: $\leq$0.1 dB over frequency range
- Max Power: 500 w @ 920MHz (750 W @ at 122° F)
- RF Power: 300 Watts
- Let Through Voltage: $\leq$+/- 3 Volts for 3kA @ 8/20 µs Waveform
- Throughput energy: $\leq$ 0.5 µJ for 3kA @ 8/20 µs Waveform
- Temperature: -40 to 185° F Storage/Operating 122° F
- Vibration: 1G at 5 Hz up to 100Hz

- Unit Impedance: 50Ω
- VSWR: 1.1:1
- Frequency Range: 800 MHz to 2200 MHz
- Multistrike capability
- Low strike throughput energy
- Flange mount and bulkhead mount options
- Standard N-Type Female Connector on both the surge side and protected side connectors

J. Disconnect Switch:

Furnish a double pole, single throw snap switch in a weatherproof outlet box with cover, suitable for use in wet locations. Ensure outlet box and cover supports a lockout tag device. Ensure outlet box includes one ½-inch hole in back of box. Furnish mounting hardware, sealing gaskets and lockout tag.

K. Warning Signs(s) and Decal(s):

Furnish Warning Sign and Decal at locations called for in the plans. Furnish mounting hardware to secure the Sign to either metal or wood poles. Secure to the pole using 'Band-It' brackets or a method approved by the engineer.

4.3.CONSTRUCTION METHODS

A. General:

Perform a radio path Site Survey test before installing any equipment. Ensure the test evaluates the Signal Strength (dBm), Fade Margin (dB), Signal-to-Noise Ratio, Data Integrity (poll test), and a complete frequency spectrum scan. Ensure the radio path site survey test is performed using the supplied brand of radio equipment to be deployed. During the initial radio path signal strength test it may be determined that a repeater station may be necessary to complete the intended link. Provide the test results to the Engineer for review and approval. Submit copies of the test results and colored copies of the frequency spectrum scan along with an electronic copy of this information. The Engineer will approve final locations of antennas and any necessary repeater stations. Install an antenna splitter cable at locations where it is determined that a dual antenna configuration is necessary to accommodate communications in multiple directions.

Install the antenna in such a manner that avoids conflicts with other utilities (separation distances in accordance with the guidelines of the NESC) and as specified in the antenna manufacturer's recommendations. Secure the antenna mounting hardware to the pole and route the coaxial cable such that no strain is placed on the N-Type Male coaxial connectors. On wood pole installations, bond the antenna mounting hardware to the pole ground using # 6 AWG bare copper wire using split bolt or compression type fitting.

Install the coaxial cable shield grounding system by carefully removing the outer jacket of the coaxial cable without damaging the cable shield. Install the shield grounding system following the cable manufacturer's recommendations. Install and weatherproof the connection using the appropriate weatherproofing materials and following the manufacturer's recommendations. On wood poles, secure the #6 AWG grounding lead cable to the pole ground using split bolt or compression type fitting or an Engineer approved method. On metal poles, secure the #6 AWG grounding lead cable to the pole using an Engineer approved method.

Do not exceed the 1-inch bend radius of the coaxial cable as it traverses from the cabinet to the antenna assembly. Connect the lightning arrestor to the coaxial cable in the equipment cabinet. Properly ground and secure the arrestor in the cabinet. Permanently label all cables entering the

cabinet. Ensure the power supply for the radio system is **NOT** connected to the GFCI receptacle circuit located in the cabinet. Place a copy of all manufacturer equipment specifications and instruction and maintenance manuals in the equipment cabinet.

At certain locations it may be necessary to integrate the radio system with a fiber optic system. Follow the details shown in the fiber optic splice plans.

B. Repeater Cabinets:

Do not obstruct the sight distance of vehicles when locating and installing cabinets.

Install the pole-mounted cabinet approximately five feet from the ground line to the top of the cabinet. Secure the cabinet to the pole using 'Band-It' brackets or a method approved by the Engineer. Leave the RS-232 data interface cable in the cabinet.

C. Disconnect Switch:

At all locations install a double pole, snap switch to remove power from the spread spectrum wireless radio system. Do not mount weatherproof box on the traffic signal cabinet door. Drill a hole in the side of the traffic signal cabinet. Mount the outlet box over the hole using a ½-inch chase nipple and bushings. Ensure sealing gaskets are in place and no water can enter the cabinet. Securely mount the weatherproof outlet box with additional mounting screws. Bond the outlet box to the equipment ground bus. See plans for approximate mounting height. Run the power supply cord of the spread spectrum radio unit into the outlet box and connect to switch. Securely attach power supply cord to equipment rack. Install disconnect switch with lockout tag cover.

Do not install power supply for the radio in a GFCI protected outlet.

D. Warning Sign(s) and Decal(s):

Secure Warning Sign to pole. Mount Warning Sign(s) at locations called for on the plans. Ensure there are no conflicts between the warning sign and surrounding utilities. Mount Warning Sign to be easily viewed. Do not mount Warning Sign under pole grounds or conduit.

Clean and remove any dirt or oil on traffic cabinet before placing Decal. Place decal adjacent to the disconnect switch located on the outside of traffic cabinet.

4.4. ELECTRICAL SERVICE

A. General:

Install new electrical service where required by the plans. Coordinate all work involving electrical service with the appropriate electrical utility company.

B. Materials:

Construct electrical service installations in accordance with the *Standard Specifications*. For locations shown on the plans requiring new electrical service, provide a service that includes a new external service disconnect (breaker box) and a meter base. Run service cable separately in 1" rigid metallic conduit (RMC). Do not allow the service conductors to share conduits with any other conductors or communications.

Provide an external electrical service disconnect at all new and existing cabinet locations shown on the plans. Provide a service disconnect with a single pole 50 ampere circuit breaker with a minimum of 10,000 RMS symmetrical amperes short circuit rating in a lockable NEMA 3R enclosure. Provide a ground bus and neutral bus with a minimum of four terminals with a minimum wire capacity of number 14 through number 4.

For pole mounted cabinets, mount the service on an existing pole as indicated in the plans, and extend the service cables into the cabinet through a new 1" RMC.

Coordinate with utility company to ascertain the practicality of installing electrical service at each location before performing any work.

C. Construction Methods:

1) Electrical Service

At locations where new electrical service is to be installed on wood or metal poles, furnish and install electrical service as required by the plans. After installation of the meter base, the utility company will transfer the existing meter or install a new meter if required and make any necessary connections to the power lines. Ground the new electrical service in accordance with Division 17 of the *Standard Specifications* and *Standard Drawings*.

2) External Electrical Service Disconnect

Furnish and install new external electrical service disconnect (breaker box) of the type shown in the plans. Route the electrical service through the meter base and service disconnect to the controller cabinet to form a complete electrical service assembly as shown in the plans. Ensure that the existing grounding system for the existing electrical service with new service disconnect complies with the grounding requirements of these special provisions and Division 17 of the *Standard Specifications* and *Standard Drawings*.

4.5. WARRANTY

Provide a minimum two-year warranty with each radio and antenna assembly to ensure the products are free of manufacturing defects in material and workmanship. The warranty commences on the date the radio system is accepted by the Engineer.

4.6. MEASURMENT AND PAYMENT

Actual number of 900MHz wireless radio systems and antenna(s) furnished, installed and accepted. This item includes the appropriate antenna, coaxial cable, splitter cable, coaxial cable shield grounding system with weatherproofing, lightning arrestor, labeling and any integration between the wireless radio system and a fiber optic network if necessary.

All power supplies, power cords, adapters, antenna mounting hardware, connectors, serial cables, signs, decals, disconnect switches, installation materials and configuration software necessary to complete this work, including the radio path Site Survey test and warranties, will be incidental. Final payment will be made when work is accepted by the Engineer.

Actual number of 900MHz wireless repeater standalone radio systems furnished, installed and accepted. This item includes the cabinet, antenna(s) and mounting hardware, coaxial cable, splitter cable, coaxial cable shield grounding system with weatherproofing, lightning arrestor, signs, decals, disconnect switches, installation materials, configuration software, the radio path Site Survey test and warranties. Final payment will be made when work is accepted by the Engineer. Riser assemblies will be paid for separately.

Actual number of new electrical services furnished, installed and tested. Riser assemblies (1-inch), meter bases, service disconnects, underground and exposed conduit runs to the cabinet, acquisition of service fees, electrical service conductors, ground rod, ground wire and any remaining hardware and conduit to connect the electrical service to the cabinet are considered incidental to installing a new electrical service.

Actual number of modified electrical services, including service disconnects, furnished, installed, and integrated into an existing service to form a complete electrical service. Any electrical service

conductors, remaining hardware and conduit to connect the electrical service to the cabinet are considered incidental to the service disconnects. No separate payment will be made for extending or replacing electrical service cable and conduits.

Payment will be made under:

900MHz Wireless Radio System ..... Each
900MHz Wireless Repeater Standalone Radio System ..... Each
New Electrical Service ..... Each
Modify Electrical Service ..... Each

5. METAL TRAFFIC SIGNAL SUPPORTS

5.1. METAL TRAFFIC SIGNAL SUPPORTS – ALL POLES

A. General:

Furnish and install metal poles with mast arms, grounding systems, and all necessary hardware. The work covered by this special provision includes requirements for the design, fabrication, and installation of both standard and custom/site specifically designed metal traffic signal supports and associated foundations.

Provide metal traffic signal support systems that contain no guy assemblies, struts, or stay braces. Provide designs of completed assemblies with hardware that equals or exceeds AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals* 4th Edition, 2001 (hereafter called 4th Edition AASHTO), including the latest interim specifications. Provide assemblies with a round or near-round cross-sectional design consisting of no less than six sides. The sides may be straight, convex, or concave.

Standard Drawings for Metal Poles are available that supplement these project special provisions. These drawings are located on the Department's website:

http://www.ncdot.org/doh/preconstruct/traffic/ITSS/ws/mpoles/poles.html

The required drawings are M 1, M 2, M 4-5 (mast arm poles), M 7.

Comply with Subarticle 1098-1B "General Requirements" of the *Standard Specifications* for submittal requirements. Furnish shop drawings for approval. Provide triplicate copies of detailed shop drawings for each type of structure. Ensure that shop drawings show materials specifications for each component and identifies welds by type and size. Do not release structures for fabrication until structural drawings have been approved. Provide an itemized bill of materials for all structural components and associated connecting hardware on the drawings.

If plans call for Standard Metal Signal Supports, comply with Subarticle 1098-1A "General Requirements" for QPL submittals. In addition to these requirements, provide a sealed copy of the pre-approved shop drawings that includes a signal inventory number and project number or work order number on the drawings. Provide design calculations with these submittals.

Summary of information needed for metal pole review submittals:

- Shop drawings & supporting calculations
- Foundation design (custom designed poles only)
- Standard Metal Pole Foundation Selection Form (standard poles only)
- Soil boring logs
- Soil boring location map or other means to correlate borings and the corresponding poles
- Geotechnical report

B. Materials:

Fabricate monotube shafts with a uniform linear taper of 0.14 in/ft with steel that conforms to ASTM A-595 minimum Grade A or an approved equivalent. Galvanize in accordance with AASHTO M111.

Use the submerged arc process to continuously weld shafts for the entire length. Ground or roll smooth exposed welds until flush with the base metal. Ensure shafts have no circumferential welds except at the lower end joining the shaft to the base. Provide welding that conforms to Article 1072-20 of the *Standard Specifications*, except that no field welding on any part of the pole will be permitted.

Refer to Standard Drawings for Metal Poles M2 for fabrication details. Fabricate anchor bases from plate steel meeting the requirements of ASTM A 36M or cast steel meeting the requirements of ASTM A 27M Grade 485-250, AASHTO M270 grade 36 or an approved equivalent. Conform to the applicable bolt pattern and orientation specified by the design as shown on drawing M2.

Ensure hardware is galvanized steel or stainless steel.

Ensure material used in steel anchor bolts conforms to AASHTO M 314, and yield strength does not exceed 55,000 psi. Unless otherwise required by the design, ensure each anchor bolt is 2" in diameter and 60" in length. Provide 10" minimum thread projection at the top of the bolt, and 8" minimum at the bottom of the bolt. Galvanize each anchor bolt in accordance with AASHTO M232 or M298 from the top of the bolt to a minimum of 2" below the threads.

Provide a circular anchor bolt lock plate that will be secured to the anchor bolts at the embedded end with 2 washers and nuts. Provide a base plate template that matches the bolt circle diameter of the anchor bolt lock plate. Construct plates and templates from ¼" minimum thick steel with a minimum width of 4". Galvanizing is not required.

Provide 4 heavy hex nuts and 4 flat washers for each anchor bolt. For nuts, use AASHTO M291 grade 2H, DH, or DH3 or equivalent material. For flat washers, use AASHTO M293 or equivalent material.

Ensure end caps for poles or mast arms are constructed of cast aluminum conforming to Aluminum Association Alloy 356.0F.

C. Construction Methods:

Erect signal supports poles only after concrete has attained a minimum allowable compressive strength of 3000 psi. Follow anchor nut-tightening procedures below to complete the installation of the upright. For further construction methods, see construction methods forMetal Pole with Mast Arm.

Connect poles to grounding electrodes and the intersection grounding systems.

For holes in the poles used to accommodate cables, install grommets before wiring pole or arm. Do not cut or split grommets.

Attach the terminal compartment cover to the pole by a sturdy chain or cable. Ensure the chain or cable is long enough to permit the cover to hang clear of the compartment opening when the cover is removed, and is strong enough to prevent vandals from being able to disconnect the cover from the pole. Ensure the chain or cable will not interfere with service to the cables in the pole base.

Attach cap to pole with a sturdy chain or cable. Ensure the chain or cable is long enough to permit the cap to hang clear of the opening when the cap is removed.

Perform repair of damaged galvanizing that complies with the *Standard Specifications*, Article 1076-6 "Repair of Galvanizing."

Anchor Nut Tightening Procedure

Compute the required projection of the anchor bolt above the foundation top. Compute the total projection based on the following:

- Provide between 3 and 5 threads of anchor bolt projection above the top nut after tightening is complete. Avoid any additional projection, or a normal depth socket torque wrench can not be used on top nuts.
- Include the sum of the thickness of top nut, top nut flat washer or top nut beveled washer, base plate, leveling nut flat washer or leveling nut beveled washer, and leveling nut.
- Set the maximum distance between the bottom of the leveling nut and the foundation top to one nut height to avoid excessive bending stresses in the anchor bolt under service conditions.
- Do not use lock washers.

Installation Procedure:

1. Place a leveling nut and washer on each anchor bolt and install a template on top of the leveling nuts to verify that the nuts are level and uniformly contact the template. Use beveled washers if the leveling nuts cannot be brought into firm contact with the template. Verify that the distance between the bottom of the leveling nuts and the top of the concrete is no more than one nut height. Consider how attachments and applied loads may affect the vertical nature of the metal pole after erected and fully loaded. If necessary, induce a rake to the upright in the opposite direction of the anticipated loads during the initial erection by adjusting the leveling nuts accordingly. Failure to consider this could result in the upright being out of the allowable vertical tolerance as specified in the Metal Strain Pole Construction Methods of this special provision.
2. Install the vertical upright on the anchor bolts, and tighten nuts in compliance with steps 3, 4, and 5 below. Do not attach cantilever arms or messenger cable to the vertical post until all of the top nuts and leveling nuts have been properly tightened on the anchor bolts.
3. Install top nuts and washers. Install flat washers under the top and leveling nuts. Use beveled washers if the nuts cannot be brought into firm contact with the base plate. Lubricate threads of the anchor bolts, nuts, and bearing surface of the nuts and tighten to a snug-tight condition with a spud wrench following a star pattern (using at least two increments). Snug-tight condition is defined as 20% to 30% of the verification torque (600 ft-lbs.). Ensure lubricant is beeswax, stick paraffin, or other approved lubricant.
4. After the top nuts have been snug tightened, snug tighten the bottom nuts up to the base plate using the same procedure as described above. The base-plate must be in firm contact with both the top and bottom nuts to achieve the proper pretension in the anchor bolts.
5. Before further turning of the nuts, mark the reference position of the top nut in the snug-tight condition by match marking each nut, bolt shank, and base plate. Use ink or paint that is not water-soluble.
6. Turn the top nuts in increments using the star pattern (using at least two full tightening cycles) to 1/6 of a turn. Use a torque wrench to verify that at least 600 ft-lbs. is required to further tighten the top nuts. At least 48 hours after the entire structure and any attachments are erected, use a torque wrench again to verify that at least 600 ft-lbs. is still required to tighten the top nuts. Verify that the leveling nuts remain in firm contact with the base plate.

7. Do not place non-shrink grout between the base plate and foundation. This will allow for future inspection of leveling nuts and for adequate drainage of moisture.

5.2. METAL POLE WITH MAST ARM

A. Materials:

Fabricate arms from standard weight black steel pipe conforming to ASTM A 53-90a, Type E or Type S, Grade B or an approved equivalent.

After all fabricating, cutting, punching, and welding is completed, hot-dip galvanize the structure in accordance with the 4th Edition AASHTO M111.

B. Construction Methods:

Install horizontal-type arms within 2 degrees of horizontal when loaded with signal heads and signs.

Attach cap to the mast arm with a sturdy chain or cable. Ensure that the chain or cable is long enough to permit the cap to hang clear of the arm opening when the cap is removed.

5.3. DRILLED PIER FOUNDATIONS FOR METAL TRAFFIC SIGNAL POLES

A. Description:

Perform a soil test at each proposed metal pole location. Furnish and install foundations for NCDOT metal poles with all necessary hardware in accordance with the plans and specifications.

Metal Pole Standards have been developed and implemented by NCDOT for use at signalized intersections in North Carolina. If the plans call for a standard pole, then a standard foundation may be selected from the plans. However, the Contractor is not required to use a standard foundation. If the Contractor chooses to design a non-standard site-specific foundation for a standard pole or if the plans call for a non-standard site-specific pole, design the foundation to conform to the applicable provisions in the NCDOT Metal Pole Standards and Section B4 (Non-Standard Foundation Design) below. If non-standard site specific foundations are designed for standard QPL approved strain poles, the foundation designer must use the design moment specified by load case on drawing M8 of the Standard Drawings for Metal Poles. Failure to conform to this requirement will be grounds for rejection of the design.

If the Contractor chooses to design a non-standard foundation for a standard pole and the soil test results indicate a standard foundation is feasible for the site, the Contractor will be paid the cost of the standard foundation (drilled pier and wing wall, if applicable). Any additional costs associated with a non-standard site-specific foundation including additional materials, labor and equipment will be considered incidental to the cost of the standard foundation. All costs for the non-standard foundation design will also be considered incidental to the cost of the standard foundation.

B. Soil Test and Foundation Determination:

1. General:

Drilled piers are reinforced concrete sections, cast-in-place against in situ, undisturbed material. Drilled piers are of straight shaft type and vertical.

Some standard drilled piers for supporting poles with mast arms may require wing walls to resist torsional rotation. Based upon this provision and the results of the required soil test, a drilled pier length and wing wall requirement may be determined and constructed in accordance with the plans.

For non-standard site-specific poles, the contractor-selected pole fabricator will determine if the addition of wing walls is necessary for the supporting foundations.

2. Soil Test:

Perform a soil test at each signal location. Complete all required fill placement and excavation at each signal pole location to finished grade before drilling each boring. Drill one boring to a depth of 26 feet.

Perform standard penetration tests (SPT) in accordance with ASTM D 1586 at depths of 1, 2.5, 5, 7.5, 10, 15, 20 and 26 feet. Discontinue the boring if one of the following occurs:

- A total of 100 blows have been applied in any 2 consecutive 6-in. intervals.
- A total of 50 blows have been applied with < 3-in. penetration.

Describe each intersection as the "Intersection of *(Route or SR #)*, *(Street Name)* and *(Route or SR #)*, *(Street Name)*, _____ County, Signal Inventory No. _____". Label borings with "B- *N, S, E, W, NE, NW, SE or SW*" corresponding to the quadrant location within the intersection. Pole numbers should be made available to the drill contractor. Include pole numbers in the boring label if they are available. If they are not available, ensure the boring labels can be cross-referenced to corresponding pole numbers. For each boring, submit a legible (hand written or typed) boring log signed and sealed by a licensed geologist or professional engineer registered in North Carolina. Include on each boring the SPT blow counts and N-values at each depth, depth of the boring, and a general description of the soil types encountered.

3. Standard Foundation Determination:

Use the following method for determining the Design N-value:

$$N_{AVG} = \frac{(N@1' + N@2.5' + \ldots\ldots N@\text{Deepest Boring Depth})}{\text{Total Number of N-values}}$$

$$Y = (N@1')^2 + (N@2.5')^2 + \ldots\ldots (N@\text{Deepest Boring Depth})^2$$

$$Z = (N@1' + N@2.5' + \ldots\ldots N@\text{Deepest Boring Depth})$$

$$N_{STD\ DEV} = \left(\frac{(\text{Total Number of N-values} \times Y) - Z^2}{(\text{Total Number of N-values}) \times (\text{Total Number of N-values} - 1)} \right)^{0.5}$$

Design N-value equals lesser of the following two conditions:

$N_{AVG} - (N_{STD\ DEV} \times 0.45)$

Or

$$\text{Average of First Four N-Values} = \frac{(N@1' + N@2.5' + N@5' + N@7.5')}{4}$$

Note: If less than 4 N-values are obtained because of criteria listed in Section 2 above, use average of N-values collected for second condition. Do not include the N-value at the deepest boring depth for above calculations if the boring is discontinued at or before the required boring depth because of criteria listed in Section 2 above. Use N-value of zero for weight of hammer or weight of rod. If N-value is greater than 50, reduce N-value to 50 for calculations.

If standard NCDOT strain poles are shown on the plans and the Contractor chooses to use standard foundations, determine a drilled pier length, "L," for each signal pole from the Standard Foundations Chart (sheet M 8) based on the Design N-value and the predominant soil type. For each standard pole location, submit a completed "Metal Pole Standard Foundation Selection Form"

signed by the contractor's representative. Include the Design N-value calculation and resulting drilled pier length, "L," on each form.

If non-standard site-specific poles are shown on the plans, submit completed boring logs collected in accordance with Section 2 (Soil Test) above along with pole loading diagrams from the plans to the contractor-selected pole fabricator to assist in the pole and foundation design.

If one of the following occurs, the Standard Foundations Chart shown on the plans may not be used and a non-standard foundation may be required. In such case, contact the Engineer.

- The Design N-value is less than 4.
- The drilled pier length, "L", determined from the Standard Foundations Chart, is greater than the depth of the corresponding boring.

In the case where a standard foundation cannot be used, the Department will be responsible for the additional cost of the non-standard foundation.

The Standard Foundations Chart is based on level ground around the traffic signal pole. If the distance between the edge of the drilled pier and the top of a slope steeper than 2:1 (H:V) is less than 10 feet or the grade within 10 feet is steeper than 2:1 (H:V), contact the Engineer.

The "Metal Pole Standard Foundation Selection Form" may be found at:

http://www.ncdot.org/doh/preconstruct/highway/geotech/formdet/mpsfsf.pdf

If assistance is needed with the required calculations, contact the Signals and Geometrics Structural Engineer at (919) 773-2800. However, in no case will the failure or inability to contact the Signals and Geometrics Structural Engineer be cause for any claims or requests for additional compensation.

4. Non-Standard Foundation Design:

Design non-standard foundations based upon site-specific soil test information collected in accordance with Section 2 (Soil Test) above. Provide a drilled pier foundation for each pole with a length and diameter that results in a horizontal lateral movement of less than 1 inch at the top of the pier and a horizontal rotational movement of less than 1 inch at the edge of the pier. Contact the Engineer for pole loading diagrams for standard poles to be used for non-standard foundation designs. Submit any non-standard foundation designs including plans, calculations, and soil boring logs to the Engineer for review and approval before construction. A professional engineer registered in the state of North Carolina must seal all plans and calculations.

C. Drilled Pier Construction:

1. Excavation:

Perform excavations for drilled piers to the required dimensions and lengths including all miscellaneous grading and excavation necessary to install the drilled pier. Depending on the subsurface conditions encountered, excavation in weathered rock or removal of boulders may be required.

Dispose of drilling spoils as directed and in accordance with Section 802 of the *Standard Specifications*. Drilling spoils consist of all material excavated including water or slurry removed from the excavation either by pumping or with augers.

Construct all drilled piers such that the piers are cast against undisturbed soil. If a larger casing and drilled pier are required as a result of unstable or caving material during drilling, backfill the excavation before removing the casing to be replaced. No additional payment will be made for substituting a larger diameter drilled pier in order to construct a drilled pier cast against undisturbed soil.

Construct drilled piers within the tolerances specified herein. If tolerances are exceeded, provide additional construction as approved by the Engineer to bring the piers within the tolerances specified. Construct drilled piers such that the axis at the top of the piers is no more than 3 inches in any direction from the specified position. Build drilled piers within 1% of the plumb deviation for the total length of the piers. Construct the finished top of pier elevation between 5 inches above and 2 inches above the finished grade elevation. Form the top of the pier such that the concrete is smooth and level.

If unstable, caving, or sloughing soils are anticipated or encountered, stabilize drilled pier excavations with either steel casing or polymer slurry. Steel casing may be either the sectional type or one continuous corrugated or non-corrugated piece. Ensure all steel casings consist of clean watertight steel of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth or backfill. Use steel casings with an outside diameter equal to the specified pier size and a minimum wall thickness of 1/4 inches. Extract all temporary casings during concrete placement in accordance with this special provision unless the Contractor chooses to leave the casing in place in accordance with the requirements below.

Any temporary steel casing that becomes bound or fouled during pier construction and cannot be practically removed may constitute a defect in the drilled pier. Improve such defective piers to the satisfaction of the Engineer by removing the concrete and enlarging the drilled pier, providing a replacement pier or other approved means. All corrective measures including redesign as a result of defective piers will not be cause for any claims or requests for additional compensation.

Any steel casing left in place will be considered permanent casing. Permanent steel casings are only allowed for strain poles. When installing permanent casing, do not drill or excavate below the tip of the permanent casing at any time such that the permanent casing is against undisturbed soil. The Contractor may excavate a hole smaller than the specified pier size to facilitate permanent casing installation. Ensure the sides of the excavation do not slough during drilling. Ensure the hole diameter does not become larger than the inside diameter of the casing. No additional compensation will be paid for permanent casing.

If polymer slurry is chosen to stabilize the excavation, use one of the following polymers listed in the table below:

PRODUCT	MANUFACTURER
SlurryPro CDP	KB Technologies Ltd 3648 FM 1960 West, Suite 107 Houston, TX 77068 (800) 525-5237
Super Mud	PDS Company 105 West Sharp Street El Dorado, AR 71730 (800) 243-7455
Shore Pac GCV	CETCO Drilling Products Group 1500 West Shure Drive Arlington Heights, IL 60004 (800) 527-9948
Novagel Polymer	Geo-Tech Drilling Fluids 220 North Zapata Hwy, Suite 11A Laredo, TX 78043 (210) 587-4758

Use slurry in accordance with the manufacturer's guidelines and recommendations unless approved otherwise by the Engineer. The Contractor should be aware that polymer slurry may not be appropriate for a given site. Polymer slurry should not be used for excavations in soft or loose soils as determined by the Engineer.

In wet pour conditions, advise and gain approval from the Engineer as to the planned construction method intended for the complete installation of the drilled pier before excavating.

2. Reinforcing Steel:

Completely assemble a cage of reinforcing steel consisting of longitudinal and spiral bars and place cage in the drilled pier excavation as a unit immediately upon completion of drilling unless the excavation is entirely cased. If the drilled pier excavation is entirely cased down to the tip, immediate placement of the reinforcing steel is not required.

Lift the cage so racking and cage distortion does not occur. Keep the cage plumb during concrete operations and casing extraction. Check the position of the cage before and after placing the concrete.

Securely cross-tie the vertical and spiral reinforcement at each intersection with double wire. Support or hold down the cage so that the vertical displacement during concrete placement and casing extraction does not exceed 2 inches.

Do not set the cage on the bottom of the drilled pier excavation. Place plastic bolsters under each vertical reinforcing bar that are tall enough to raise the rebar cage off the bottom of the drilled pier excavation a minimum of 3 inches.

In order to ensure a minimum of 3 inches of concrete cover and achieve concentric spacing of the cage within the pier, tie plastic spacer wheels at five points around the cage perimeter. Use spacer wheels that provide a minimum of 3 inches "blocking" from the outside face of the spiral bars to the outermost surface of the drilled pier. Tie spacer wheels that snap together with wire and allow them to rotate. Use spacer wheels that span at least two adjacent vertical bars. Start placing spacer wheels at the bottom of the cage and continue up along its length at maximum 10-foot intervals. Supply additional peripheral spacer wheels at closer intervals as necessary or as directed by the Engineer.

3. Concrete:

Begin concrete placement immediately after inserting reinforcing steel into the drilled pier excavation. If the drilled pier excavation is entirely cased down to the tip, immediately placement of the concrete is not required.

a) Concrete Mix

Provide the mix design for drilled pier concrete for approval and, except as modified herein, meeting the requirements of Section 1000 of the *Standard Specifications*.

Designate the concrete as Drilled Pier Concrete with a minimum compressive strength of 4500 psi at 28 days. The Contractor may use a high early strength mix. Make certain the cementitious material content complies with one of the following options:

- Provide a minimum cement content of 640 lbs/yd^3 and a maximum cement content of 800 lbs/yd^3; however, if the alkali content of the cement exceeds 0.4%, reduce the cement content by 20% and replace it with fly ash at the rate of 1.2 lb of fly ash per lb of cement removed.
- If Type IP blended cement is used, use a minimum of 665 lbs/yd^3 Type IP blended cement and a maximum of 833 lbs/yd^3 Type IP blended cement in the mix.

Limit the water-cementitious material ratio to a maximum of 0.45. Do not air-entrain drilled pier concrete.

Produce a workable mix so that vibrating or prodding is not required to consolidate the concrete. When placing the concrete, make certain the slump is between 5 and 7 inches for dry placement of concrete or 7 and 9 inches for wet placement of concrete.

Use Type I or Type II cement or Type IP blended cement and either No. 67 or No. 78M coarse aggregate in the mix. Use an approved water-reducer, water-reducing retarder, high-range water-reducer or high-range water-reducing retarder to facilitate placement of the concrete if necessary. Do not use a stabilizing admixture as a retarder in Drilled Pier Concrete without approval of the Engineer. Use admixtures that satisfy AASHTO M194 and add admixtures at the concrete plant when the mixing water is introduced into the concrete. Redosing of admixtures is not permitted.

Place the concrete within 2 hours after introducing the mixing water. Ensure that the concrete temperature at the time of placement is 90°F or less.

b) Concrete Placement

Place concrete such that the drilled pier is a monolithic structure. Temporary casing may be completely removed and concrete placement may be temporarily stopped when the concrete level is within 42 to 48 inches of the ground elevation to allow for placement of anchor bolts and conduit. Do not pause concrete placement if unstable caving soils are present at the ground surface. Remove any water or slurry above the concrete and clean the concrete surface of all scum and sediment to expose clean, uncontaminated concrete before inserting the anchor bolts and conduit. Resume concrete pouring within 2 hours.

Do not dewater any drilled pier excavations unless the excavation is entirely cased down to tip. Do not begin to remove the temporary casing until the level of concrete within the casing is in excess of 10 feet above the bottom of the casing being removed. Maintain the concrete level at least 10 feet above the bottom of casing throughout the entire casing extraction operation except when concrete is near the top of the drilled pier elevation. Maintain a sufficient head of concrete above the bottom of casing to overcome outside soil and water pressure. As the temporary casing is withdrawn, exercise care in maintaining an adequate level of concrete within the casing so that fluid trapped behind the casing is displaced upward and discharged at the ground surface without contaminating or displacing the drilled pier concrete. Exerting downward pressure, hammering, or vibrating the temporary casing is permitted to facilitate extraction.

Keep a record of the volume of concrete placed in each drilled pier excavation and make it available to the Engineer.

After all the pumps have been removed from the excavation, the water inflow rate determines the concrete placement procedure. If the inflow rate is less than 6 inches per half hour, the concrete placement is considered dry. If the water inflow rate is greater than 6 inches per half hour, the concrete placement is considered wet.

- **Dry Placement:** Before placing concrete, make certain the drilled pier excavation is dry so the flow of concrete completely around the reinforcing steel can be certified by visual inspection. Place the concrete by free fall with a central drop method where the concrete is chuted directly down the center of the excavation.
- **Wet Placement:** Maintain a static water or slurry level in the excavation before placing concrete. Place concrete with a tremie or a pump in accordance with the applicable parts of Sections 420-6 and 420-8 of the *Standard Specifications*. Use a tremie tube or pump pipe made of steel with watertight joints. Passing concrete through a hopper at the tube end or through side

openings as the tremie is retrieved during concrete placement is permitted. Use a discharge control to prevent concrete contamination when the tremie tube or pump pipe is initially placed in the excavation. Extend the tremie tube or pump pipe into the concrete a minimum of 5 feet at all times except when the concrete is initially introduced into the pier excavation. If the tremie tube or pump pipe pulls out of the concrete for any reason after the initial concrete is placed, restart concrete placement with a steel capped tremie tube or pump pipe.

Once the concrete in the excavation reaches the same elevation as the static water level, placing concrete with the dry method is permitted. Before changing to the dry method of concrete placement, remove any water or slurry above the concrete and clean the concrete surface of all scum and sediment to expose clean, uncontaminated concrete.

Vibration is only permitted, if needed, in the top 10 feet of the drilled pier or as approved by the Engineer. Remove any contaminated concrete from the top of the drilled pier and wasted concrete from the area surrounding the drilled pier upon completion.

Permanently mark the top of each foundation with a stamp or embedded plate to identify the depth of the foundation.

4. Concrete Placement Time:

Place concrete within the time frames specified in Table 1000-2 of the *Standard Specifications* for Class AA concrete except as noted herein. Do not place concrete so fast as to trap air, water, fluids, soil or any other deleterious materials in the vicinity of the reinforcing steel and the annular zone between the rebar cage and the excavation walls. Should a delay occur because of concrete delivery or other factors, reduce the placement rate to maintain some movement of the concrete. No more than 45 minutes is allowed between placements.

5. Scheduling and Restrictions:

During the first 16 hours after a drilled pier has achieved its initial concrete set as determined by the Engineer, do not drill adjacent piers, install adjacent piles, or allow any heavy construction equipment loads or "excessive" vibrations to occur at any point within a 20 foot radius of the drilled pier.

The foundation will be considered acceptable for loading when the concrete reaches a minimum compressive strength of 3000 psi. This provision is intended to allow the structure to be installed on the foundation in a shorter time frame, and does not constitute full acceptance of the drilled pier. Full acceptance will be determined when the concrete meets its full strength at 28 days.

In the event that the procedures described herein are performed unsatisfactorily, the Engineer reserves the right to shut down the construction operations or reject the drilled piers. If the integrity of a drilled pier is in question, use core drilling, sonic or other approved methods at no additional cost to the Department and under the direction of the Engineer. Dewater and backfill core drill holes with an approved high strength grout with a minimum compressive strength of 4500 psi. Propose remedial measures for any defective drilled piers and obtain approval of all proposals from the Engineer before implementation. No additional compensation will be paid for losses or damage due to remedial work or any investigation of drilled piers found defective or not in accordance with these special provision or the plans.

5.4. CUSTOM DESIGN OF TRAFFIC SIGNAL SUPPORTS

A. General:

Design traffic signal supports with foundations consisting of metal strain poles or metal poles with mast arms.

The lengths of the metal signal poles shown on the plans are estimated from available data for bid purposes. Determine the actual length of each pole from field measurements and adjusted cross-sections. Furnish the revised pole heights to the Engineer. Use all other dimensional requirements shown on the plans.

Design all traffic signal support structures using the following 4th Edition AASHTO specifications:

- Design for a 50 year service life as recommended by Table 3-3 (Recommended Minimum Design Life) in the 2003 Interim to the 4th Edition AASHTO.
- Use the wind pressure map developed from 3-second gust speeds, as provided in Article 3.8.
- Ensure signal support structures include natural wind gust loading and truck-induced gust loading in the fatigue design, as provided for in Articles 11.7.3 and 11.7.4, respectively. Designs need not consider periodic galloping forces.
- Assume the natural wind gust speed in North Carolina is 11.2 mph.
- Design for Category II fatigue, as provided for in Article 11.6, unless otherwise specified.
- Calculate all stresses using applicable equations from Section 5. Maximum allowable stress ratios for all signal support designs is 0.9.
- Conform to article 10.4.2 and 11.8 for all deflection requirements.

Ensure that the design permits cables to be installed inside poles and mast arms.

Unless otherwise specified by special loading criteria, the computed surface area for ice load on signal heads is:

- 3-section, 12-inch, Surface area: 26.0 ft^2
- 4-section, 12-inch, Surface area: 32.0 ft^2
- 5-section, 12-inch, Surface area: 42.0 ft^2

The ice loading for signal heads defined above includes the additional surface area that back plates will induce. Special loading criteria may be specified in instances where back plates will not be installed on signal heads. Refer to the Loading Schedule on each Metal Pole Loading Diagram for revised signal head surface areas. The pole designer should revise ice loads accordingly in this instance. Careful examination of the plans when this is specified is important as this may impact sizing of the metal support structure and foundation design which could affect proposed bid quotes. All maximum stress ratios of 0.9 still apply.

Assume the combined minimum weight of a messenger cable bundle (including messenger cable, signal cable and detector lead-in cables) is 1.3 lbs/ft. Assume the combined minimum diameter of this cable bundle is 1.3 inches.

Ensure that designs provide a removable pole cap with stainless steel attachment screws for each pole top and mast arm end.

B. Metal Poles:

Submit design drawings for approval including pre-approved QPL poles. Show all the necessary details and calculations for the metal poles including the foundation and connections. Include signal inventory number on design drawings. Include as part of the design calculations the ASTM specification numbers for the materials to be used. Provide the types and sizes of welds on the design drawings. Include a Bill of Materials on design drawings. Ensure design drawings and calculations are signed, dated, and sealed by the responsible Professional Engineer licensed in the State of North Carolina. Immediately bring to the attention of the Engineer any structural deficiency that becomes apparent in any assembly or member of any assembly as a result of the design requirements imposed by these Specifications, the plans, or the typical drawings. Said Professional Engineer is wholly

responsible for the design of all poles and arms and review and acceptance of these designs by the Department does not relieve said Professional Engineer of this responsibility. Do not fabricate the assemblies until receipt of the Department's approval of the design drawings.

For mast arm poles, provide designs with provisions for pole plates and associated gussets and fittings for mast arm attachment. As part of each mast arm attachment, provide a grommeted cable passage hole in the pole to allow passage of the signal cables from the pole to the arm.

For strain poles, where ice is present, assume wind loads as shown in Figure 3-5 of the 4th Edition AASHTO Specification for Group III loading.

For each strain pole, provide designs with provisions for two span wire clamps and associated hardware to attach the span wire support cable. Ensure that the diameter of the clamp is appropriately designed to be adjustable from 18 inches below the top, down to 10 feet below the top of the pole.

Design tapers for all pole shafts that begin at the base with diameters that decrease uniformly at the rate of 0.14 inch per foot of length.

Design a base plate on each pole. The minimum base plate thickness for all poles is determined by the following criteria:

Case 1 Circular or rectangular solid base plate with the upright pole welded to the top surface of base plate with full penetration butt weld, and where no stiffeners are provided. A base plate with a small center hole, which is less than 1/3 of the upright diameter, and located concentrically with the upright pole, may be considered as a solid base plate.

The magnitude of bending moment in the base plate, induced by the anchoring force of each anchor bolt is $M = (P \times D_1) / 2$,

where M = bending moment at the critical section of the base plate induced by one anchor bolt
P = anchoring force of each anchor bolt
D_1 = horizontal distance between the anchor bolt center and the outer face of the upright, or the difference between the bolt circle radius and the outside radius of the upright

Locate the critical section at the face of the anchor bolt and perpendicular to the bolt circle radius. The overlapped part of two adjacent critical sections is considered ineffective.

Case 2 Circular or rectangular base plate with the upright pole socketed into and attached to the base plate with two lines of fillet weld, and where no stiffeners are provided, or any base plate with a center hole that is larger in diameter than 1/3 of the upright diameter.

The magnitude of bending moment induced by the anchoring force of each anchor bolt is $M = P \times D_2$,

where P = anchoring force of each anchor bolt
D_2 = horizontal distance between the face of the upright and the face of the anchor bolt nut

Locate the critical section at the face of the anchor bolt top nut and perpendicular to the radius of the bolt circle. The overlapped part of two adjacent critical sections is considered ineffective.

If the base plate thickness calculated for Case 2 is less than Case 1, use the thickness calculated for Case 1.

The following additional owner requirements apply concerning pole base plates.

- Ensure that whichever case governs as defined above, the anchor bolt diameter is set to match the base plate thickness. If the minimum diameter required for the anchor bolt exceeds the thickness required for the base plate, set the base plate thickness equal to the required bolt diameter.

- For dual mast arm supports, or for single mast arm supports 50' or greater, use a minimum 8 bolt orientation with 2" diameter anchor bolts, and a 2" thick base plate.
- For all metal poles with mast arms, use a full penetration groove weld with a backing ring to connect the pole upright component to the base. Refer to Standard Drawings for Metal Poles M4.

Ensure that designs have anchor bolt holes with a diameter 1/4 inch larger than the anchor bolt diameters in the base plate.

Ensure that the anchor bolts have the required diameters, lengths, and positions, and will develop strengths comparable to their respective poles.

Provide designs with a 6 x 12-inch hand hole with a reinforcing frame for each pole.

Provide designs with a terminal compartment with cover and screws in each pole that encompasses the hand hole and contains provisions for a 12-terminal barrier type terminal block.

For each pole, provide designs with provisions for a 1/2 inch minimum thread diameter, coarse thread stud and nut for grounding which will accommodate a Number 6 AWG ground wire. Ensure the lug is electrically bonded to the pole and is conveniently located inside the pole at the hand hole.

Where required, design couplings on the pole for mounting pedestrian pushbuttons at a height of 42 inches above the bottom of the base. Provide mounting points consisting of 1-1/2 inch internally threaded half-couplings that comply with the NEC that are mounted within the poles. Ensure the couplings are essentially flush with the outside surfaces of the poles and are installed before any required galvanizing. Provide a threaded plug for each half coupling. Ensure that the surface of the plug is essentially flush with the outer end of the mounting point when installed and has a recessed hole to accommodate a standard wrench.

C. Mast Arms:

Design all arm plates and necessary attachment hardware, including bolts and brackets.

Design for grommeted holes on the arms to accommodate the cables for the signals if specified.

Design arms with weatherproof connections for attaching to the shaft of the pole.

Use a full penetration groove weld with a backing ring to connect the mast arm to the pole. Refer to Standard Drawings for Metal Poles M5.

5.5. MEASUREMENT AND PAYMENT

Actual number of metal poles with single mast arms furnished, installed, and accepted.

Actual number of metal poles with dual mast arms furnished, installed, and accepted.

Actual number of soil tests with SPT borings drilled furnished and accepted.

Actual volume of concrete poured in cubic yards of drilled pier foundation furnished, installed and accepted.

Actual number of designs for mast arms with metal poles furnished and accepted.

No measurement will be made of foundation designs prepared with metal pole designs, as these will be considered incidental to designing signal support structures.

Payment will be made under:

Metal Pole with Single Mast Arm ..... Each
Metal Pole with Dual Mast Arm ..... Each
Soil Test ..... Each

Drilled Pier Foundation..... Cubic Yard
Mast Arm with Metal Pole Design .....Each

6. CONTROLLERS WITH CABINETS

6.1. MATERIALS – TYPE 170E CONTROLLERS

Conform to the CALTRANS *Traffic Signal Control Equipment Specifications* and addendum 8, *Specifications for Model 170E Enhanced Controller Unit and Associated Model 412C and Model 172 Modules* except as required herein.

Provide model 412C Program Modules as defined in CALTRANS Addendum 8 except as specified otherwise herein. Provide program module delivery with Memory Select #4 Configuration except that all RAM must be DALLAS Non-volatile RAM or an approved equal. Ensure that the removal of the program module from the controller will place the intersection into flash.

Provide diagnostic software or removable diagnostic PROM modules that will test and diagnose the following:

- systems of the controller, including the internal memory, Program Module, Real Time Clock, I/O circuitry, display, and keyboard;
- systems of the fully loaded 8 phase cabinet with overlaps, including the output file, input file, police panel, flashing operation, and cabinet switches; and
- systems of the conflict monitor by checking all possible conflicts in a logical sequence and resetting the conflict monitor each time, and by testing red failure function and red detect cable disconnects.

Ensure that the automatic reset function can be enabled by inserting a diagnostic plug in the jack labeled "Conflict Monitor Test" in the "TEST" position.

In addition to CALTRANS system communications capability between a central computer and master controller and master to local controller communications, provide communications capability with the intersection conflict monitor via an RS-232C/D port on the monitor. Ensure controller receives data from the conflict monitor through a controller Asynchronous Communications Interface Adapter (ACIA) determined by the controller software manufacturer. Ensure that with the appropriate software, the controller is capable of communicating directly through a laptop nine pin serial port to the same monitor RS-232C/D to retrieve all event log information.

Furnish a communications connecting cable with the following pin connections.

170		Conflict Monitor DB-9
RX pin L	Connect to	TX pin 2
TX pin K	Connect to	RX pin 3
+5 pin D	Connect to	DTR pin 4
GND pin N	Connect to	GND pin 5

Provide a male DB-9 connector on the cable for connection to the monitor.

Provide socket mounting for through-hole mount devices with 14 or more pins. Ensure that all sockets are AUGAT-500 series machined sockets, or equal.

Provide a moisture resistant coating on all circuit boards. Mount circuit boards vertically.

6.2. MATERIALS – GENERAL CABINETS

Provide a moisture resistant coating on all circuit boards.

Provide one V150LA20 MOV or equal protection on each load switch field terminal.

Provide a power line surge protector that is a two-stage device that will allow connection of the radio frequency interference filter between the stages of the device. Ensure that a maximum continuous current is at least 10A at 120V. Ensure that the device can withstand a minimum of 20 peak surge current occurrences at 20,000A for an 8x20 microsecond waveform. Provide a maximum clamp voltage of 280V at 20,000A with a nominal series inductance of 200μh. Ensure that the voltage does not exceed 280V. Provide devices that comply with the following:

Frequency (Hz)	Minimum Insertion Loss (dB)
60	0
10,000	30
50,000	55
100,000	50
500,000	50
2,000,000	60
5,000,000	40
10,000,000	20
20,000,000	25

6.3. MATERIALS – TYPE 170E CABINETS

A. Type 170 E Cabinets General:

Conform to CALTRANS *Traffic Signal Control Equipment Specifications* except as required herein.

Furnish fully loaded 8 vehicle phase, 4 pedestrian phase and 4 overlap phase CALTRANS Model 336S pole mounted cabinets configured for 8 vehicle phases with power distribution assemblies (PDAs) number 2, and 4 pedestrian phases or overlaps.

Furnish fully loaded 8 vehicle phase, 4 pedestrian phase and 4 overlap phase CALTRANS Model 332A base mounted cabinets with PDAs #2 and configured for 8 vehicle phases, 4 pedestrian phases, and 4 overlaps. When overlaps are required, provide auxiliary output files for the overlaps. Do not reassign load switches to accommodate overlaps unless shown on electrical details.

B. Type 170 E Cabinet Electrical Requirements:

Provide a fully loaded cabinet assembly designed to ensure that upon leaving any cabinet switch or conflict monitor initiated flashing operation, the controller starts up in the programmed start up phases and start up interval.

Furnish two sets of non-fading cabinet wiring diagrams and schematics in a paper envelope or container and placed in the cabinet drawer.

Provide surge suppression in the cabinet for each type of cabinet device. Provide surge protection for the full capacity of the cabinet input file.

All AC+ power is subject to radio frequency signal suppression.

If additional surge protected power outlets are needed to accommodate fiber transceivers, modems, etc.; install a UL listed, industrial, heavy-duty type power outlet strip with a maximum rating of 15 A / 125 VAC, 60 Hz. Provide a strip that has a minimum of 3 grounded outlets. Ensure the power outlet strip plugs into one of the controller unit receptacles located on the rear of the PDA. Ensure power outlet strip is mounted securely; provide strain relief if necessary.

Connect detector test switches for cabinets as follows:

336S Cabinet		332A Cabinet	
Detector Call Switches	**Terminals**	**Detector Call Switches**	**Terminals**
Phase 1	I1-F	Phase 1	I1-W
Phase 2	I2-F	Phase 2	I4-W
Phase 3	I3-F	Phase 3	I5-W
Phase 4	I4-F	Phase 4	I8-W
Phase 5	I5-F	Phase 5	J1-W
Phase 6	I6-F	Phase 6	J4-W
Phase 7	I7-F	Phase 7	J5-W
Phase 8	I8-F	Phase 8	J8-W

Provide a terminal mounted loop surge suppresser device for each set of loop terminals in the cabinet. For a 10x700 microsecond waveform, ensure that the device can withstand a minimum of 25 peak surge current occurrences at 100A, in both differential and common modes. Ensure that the maximum breakover voltage is 170V and the maximum on-state clamping voltage is 30V. Provide a maximum response time less than 5 nanoseconds. Ensure that off-state leakage current is less than 10 μA. Provide a nominal capacitance less than 220pf for both differential and common modes.

Provide surge suppression on each communications line entering or leaving a cabinet. Ensure that the communications surge suppresser can withstand at least 80 occurrences of an 8x20 microsecond wave form at 2000A and a 10x700 microsecond waveform at 400A. Ensure that the maximum clamping voltage is suited to the protected equipment. Provide a maximum response time less than 1 nanosecond. Provide a nominal capacitance less than 1500pf and a series resistance less than 15 Ω.

Provide surge suppression on each DC input channel in the cabinet. Ensure that the DC input channel surge suppresser can withstand a peak surge current of at least 10,000 amperes in the form of an 8x20 microsecond waveform and at least 100 occurrences of an 8x20 microsecond wave form at 2000 A. Ensure that the maximum clamping voltage is 30V. Provide a maximum response time less than 1 nanosecond and a series resistance less than 15 Ω per line.

Provide protection for each preemption or 120 Vrms single phase signal input by an external stud mounted surge protector. Ensure that a minimum stud size of 1/3 inch, and Number 14 AWG minimum sized wire leads with 1 foot minimum lengths. Ensure that a peak surge trip point less than 890 volts nominal for a 600 volt rise per microsecond impulse, and 950 volts nominal for a 3000 volt per microsecond rise impulse. Provide a maximum surge response time less than 200 nanoseconds at 10 kV per microsecond. Ensure that the AC isolation channel surge suppresser can withstand at least 25 occurrences of a 8x20 waveform of 10,000 amperes and a peak single pulse 8x20 microsecond wave form of 20,000 amperes. Provide a maximum clamping voltage of 30V. Provide a maximum response time less than 1 nanosecond. Ensure that the discharge voltage is under 200 volts at 1000 amperes and the insulation resistance is 100 megaohms. Provide an absolute maximum operating line current of one ampere at 120 Vrms.

Provide conductors for surge protection wiring that are of sufficient size (ampacity) to withstand maximum overcurrents which could occur before protective device thresholds are attained and current flow is interrupted.

Furnish a fluorescent fixture in the rear across the top of the cabinet and another fluorescent fixture in the front across the top of the cabinet at a minimum. Ensure that the fixtures provide sufficient light to illuminate all terminals, labels, switches, and devices in the cabinet. Conveniently

locate the fixtures so as not to interfere with a technician's ability to perform work on any devices or terminals in the cabinet. Provide a protective diffuser to cover exposed bulbs. Furnish all bulbs with the cabinet. Provide door switch actuation for the fixtures.

Furnish a police panel with a police panel door. Ensure that the police panel door permits access to the police panel when the main door is closed. Ensure that no rainwater can enter the cabinet even with the police panel door open. Provide a police panel door hinged on the right side as viewed from the front. Provide a police panel door lock that is keyed to a standard police/fire call box key. In addition to CALTRANS Specifications, provide the police panel with a toggle switch connected to switch the intersection operation between normal stop-and-go operation (AUTO) and manual operation (MANUAL). Ensure that manual control can be implemented using inputs and software such that the controller provides full programmed clearance times for the yellow clearance and red clearance for each phase while under manual control.

Provide a 1/4-inch locking phone jack in the police panel for a hand control to manually control the intersection. Provide sufficient room in the police panel for storage of a hand control and cord.

Provide detector test switches inside the cabinet on the door or other convenient location which may be used to place a call on each of eight phases based on standard CALTRANS input file designation for detector racks. Provide three positions for each switch: On (place call), Off (normal detector operation), and Momentary On (place momentary call and return to normal detector operation after switch is released). Ensure that the switches are located such that the technician can read the controller display and observe the intersection.

Provide a shorting jack inside cabinet that functions exclusively to call the controller and cabinet assembly into the automatic diagnostics functions. Ensure shorting jack will mate with a Switchcraft Model 190 plug or equivalent. Place jack in a convenient, unobstructed location inside cabinet. When the mating plug is inserted into the jack, ensure controller enters the diagnostic test mode and a controller generated monitor reset signal is placed on Pin C1-102 (monitor external reset) of the model 210 conflict monitor which causes the monitor to automatically reset.

Equip cabinet with a connector and terminal assembly designated as P20 (Magnum P/N 722120 or equivalent) for monitoring the absence of any valid AC+ signal display (defined here as red, yellow, or green) input on any channel of the conflict monitor. Connect the terminal through a 3 1/2 feet 20 wire ribbon cable which mates on the other end to a connector (3M-3428-5302 or equivalent) installed in the front of the Type 210 enhanced conflict monitor. Ensure that the female connector which mates with the connector on the conflict monitor has keys to ensure that proper connection. Ensure that the cabinet enters the flash mode if the ribbon cable is not properly connected. Provide a P20 connector and terminal assembly that conforms to Los Angeles City DOT "Traffic Signal Specification DOT 170 ATSAC Universal and Related Equipment #54-053-02".

Terminate ribbon cable at the P20 connector and terminal assembly. Ensure the P20 connector and mating ribbon cable connector is keyed to prevent cable from being improperly installed. Wire the P20 connector to the traffic signal red displays to provide inputs to conflict monitor as shown:

Pin #	Function	Pin #	Function
1	Channel 15 Red	11	Channel 9 Red
2	Channel 16 Red	12	Channel 8 Red
3	Channel 14 Red	13	Channel 7 Red
4	GND	14	Channel 6 Red
5	Channel 13 Red	15	Channel 5 Red
6	Special Function 2	16	Channel 4 Red
7	Channel 12 Red	17	Channel 3 Red
8	Special Function 1	18	Channel 2 Red
9	Channel 10 Red	19	Channel 1 Red
10	Channel 11 Red	20	Red Enable

Provide a convenient means to jumper 120 VAC from the signal load switch AC+ supply bus to any channel Red input to the P20 connector in order to tie unused red inputs high. Ensure that easy access is provided to the jumper connecting terminals on the back side of cabinet. Locate the jumper terminals connecting to all 16 channel Red inputs in the same terminal block. For each channel Red input terminal, provide a companion terminal supplying AC+ from the signal bus. Provide one of the following two methods for providing Signal AC+ to the channel red input:

- Place a commercially available jumper plug between the channel Red input and its companion Signal Bus AC+ terminal.
- Place a jumper wire between a channel red input screw terminal and its companion Signal Bus AC+ screw terminal.

Connection between channel Red input terminal and its companion Signal Bus AC+ terminal must not require a wire greater than 1/2 inch in length.

Conform to the following Department wiring requirements:

- Wire the Red Enable monitor input to the Signal Bus AC+ terminal TB01-1.
- Do not connect either the special function 1 or the special function 2 monitor input to the red monitor card.
- Ensure that removal of the P-20 ribbon cable will cause the monitor to recognize a latching fault condition and place the cabinet into flashing operation and that this is implemented in the conflict monitor software.

Ensure that removal of the conflict monitor from the cabinet will cause the cabinet to revert to flashing operation.

Provide Model 200 load switches and Model 204 flashers.

C. Type 170 E Cabinet Physical Requirements:

Provide a surge protection panel with 16 loop protection devices and designed to allow sufficient free space for wire connection/disconnection and surge protection device replacement. Provide an additional three slots protected with six AC+ interconnect surge devices and two protected by four DC surge protection devices. Provide no protection devices on slot 14. Attach flash sense and stop time to the upper and lower slot as required.

i) For pole mounted cabinets, mount surge protection devices for the AC+ interconnect cable inputs, inductive loop detector inputs, and low voltage DC inputs on a fold down panel assembly on the rear side of the input files. Fabricate the surge protection devices from sturdy aluminum and incorporate a swing down back panel to which the surge protection devices are attached. Attach the swing down panel to the assembly using thumb screws. Have the surge

protection devices mounted horizontally on the panel and soldered to the feed through terminals of four 14 position terminal blocks with #8 screws mounted on the other side.

ii) For base mounted cabinets, attach separate surge protection termination panels to each side of the cabinet rack assembly. Mount the surge protection termination panel for AC isolation devices on the same side of the cabinet as the AC service inputs. Install the surge protection termination panel for DC terminals and loop detector terminals on the opposite side of the cabinet from the AC service inputs. Attach each panel to the rack assembly using bolts and make it easily removable. Mount the surge protection devices in horizontal rows on each panel and solder to the feed through terminals of 14 position terminal blocks with #8 screws mounted on the other side. Wire the terminals to the rear of a standard input file using spade lugs for input file protection.

Provide permanent labels that indicate the slot and the pins connected to each terminal that may be viewed from the rear cabinet door. Label and orient terminals so that each pair of inputs is next to each other. Ensure the top row of terminals is connected to the upper slots and the bottom row of terminals is connected to the bottom slots. Indicate on the labeling the slot number (1-14) and the terminal pins of the input slots (either D & E for upper or J & K for lower). Terminate all grounds from the surge protection on a 15 position copper equipment ground bus attached to the rear swing down panel. Ensure that a Number 4 AWG green wire connects the surge protection panel assembly ground bus to the main cabinet equipment ground. Provide a standard input file and surge protection panel assembly that fits outside and behind the input file. Ensure the fold down panel allows for easy removal of the input file without removing the surge protection panel assembly or its parts.

Provide a minimum 14 x 16 inch pull out, hinged top shelf located immediately below controller mounting section of the cabinet. Ensure the shelf is designed to fully expose the table surface outside the controller at a height approximately even with the bottom of the controller. Ensure the shelf has a storage bin interior which is a minimum of 1 inch deep and approximately the same dimensions as the shelf. Provide an access to the storage area by lifting the hinged top of the shelf. Fabricate the shelf and slide from aluminum or stainless steel and ensure the assembly can support the 170E controller plus 15 pounds of additional weight. Ensure shelf has a locking mechanism to secure it in the fully extended position and does not inhibit the removal of the 170E controller or removal of cards inside the controller when fully extended. Provide a locking mechanism that is easily released when the shelf is to be returned to its non-use position directly under the controller.

D. Type 170 E Model 2010 Enhanced Conflict Monitor:

Furnish Model 2010 Enhanced Conflict Monitors with 16 channels. In addition to CALTRANS requirements, ensure the conflict monitor monitors for the absence of a valid voltage level on at least one channel output of each load switch. Ensure that the absence of the programming card will cause the conflict monitor to trigger, and remain in the triggered state until reset.

Provide a conflict monitor that recognizes the faults specified by CALTRANS and the following additional per channel faults that apply for monitor inputs to each channel:

- consider a Red input greater than 70 Vrms as an "on" condition;
- consider a Red input less than 50 Vrms as an "off" condition (no valid signal);
- consider a Red input between 50 Vrms and 70 Vrms to be undefined by these specifications;
- consider a Yellow or Green input greater than 25 Vrms as an "on" condition;
- consider a Green or Yellow input less than 15 Vrms as an "off" condition; and
- consider a Green or Yellow input between 15 Vrms and 25 Vrms to be undefined by these specifications.

Ensure monitor will trigger upon detection of a fault and will remain in the triggered (failure detected) state until unit is reset at the front panel or through the remote reset input for the following failures:

1. **Red Monitoring or Absence of Any Indication (Red Failure):** A condition in which no "on" voltage signal is detected on any of the green, yellow, or red inputs to a given monitor channel. If a signal is not detected on at least one input (R, Y, or G) of a conflict monitor channel for a period greater than 1000 ms when used with a 170 controller and 1500 ms when used with a 2070L controller, ensure monitor will trigger and put the intersection into flash. If the absence of any indication condition lasts less that 750 ms when used with a 170 controller and 1200 ms when used with a 2070L controller, ensure conflict monitor will not trigger. Have red monitoring occur when the P20 Connector is installed and both the following input conditions are in effect: a) Red Enable input to monitor is active (Red Enable voltages are "on" at greater than 70 Vrms, off at less than 50 Vrms, undefined between 50 and 70 Vrms), and b) neither Special Function 1 nor Special Function 2 inputs are active.
2. **Yellow Indication Sequence Error:** Yellow indication following a green is missing or shorter than 2.7 seconds (with ± 0.1-second accuracy). If a channel fails to detect an "on" signal at the Yellow input following the detection of an "on" signal at a Green input for that channel, ensure that the monitor triggers and generates a sequence error fault indication.
3. **Dual Indications on the Same Channel:** In this condition, more than one indication (R,Y,G) is detected as "on" at the same time on the same channel. If dual indications are detected for a period greater than 500 ms, ensure that the conflict monitor triggers and displays the proper failure indication (Dual Ind fault). If this condition is detected for less than 250 ms, ensure that the monitor does not trigger.

Enable the monitor function for short/missing yellows and for dual indications on a per channel basis.

Provide Special Function 1 and Special Function 2 that comply with the Los Angeles City DOT *Traffic Signal Specification DOT 170 ATSAC Universal and Related Equipment #54-053-02* to eliminate red failure monitoring while allowing other additional enhanced fault monitoring functions to continue.

Ensure that the removal of the P-20 ribbon cable will cause the monitor to recognize a latching fault condition and place the cabinet into flashing operation.

Ensure that when the Conflict Monitor is triggered due to a fault, it provides an LED indication identifying the type of failure detected by the monitor except for the P20 ribbon cable removal fault. Ensure that the monitor indicates which channels were active during a conflict condition and which channels experienced a failure for all other per channel fault conditions detected, and that these indications and the status of each channel are retained until the Conflict Monitor is reset.

Ensure that the conflict monitor will store at least nine of the most recent malfunctions detected by the monitor in EEPROM memory. For each malfunction, record at a minimum the time, date, type of malfunction, relevant field signal indications, and specific channels involved with the malfunction.

Provide communications from the monitor to the 170/2070L controller via an RS-232C/D port on the monitor in order to upload all event log information from the monitor to the controller or to a Department-furnished system computer via the controller. Ensure that the controller can receive the data through a controller Asynchronous Communications Interface Adapter (Type 170E) or Async Serial Comm Module (2070L) determined by the controller software. Provide software capable of

communicating directly through the same monitor RS-232C/D to retrieve all event log information to a Department-furnished laptop computer.

In addition to the connectors required by the CALTRANS Specifications, provide the conflict monitor with a connector mounted on the front of the monitor (3M-3428-5302 with two polarizing keys or equal) which mates with a 20 pin ribbon cable connector that conducts the signals from the P20 connector on the cabinet assembly. Provide a P20 connector and terminal assembly that complies with the Los Angeles City DOT "Traffic Signal Specification DOT 170 ATSAC Universal and Related Equipment #54-053-02". Provide connector pins on the monitor with the following functions:

Pin #	Function	Pin #	Function
1	Channel 15 Red	11	Channel 9 Red
2	Channel 16 Red	12	Channel 8 Red
3	Channel 14 Red	13	Channel 7 Red
4	Chassis Ground	14	Channel 6 Red
5	Channel 13 Red	15	Channel 5 Red
6	Special Function 2	16	Channel 4 Red
7	Channel 12 Red	17	Channel 3 Red
8	Special Function 1	18	Channel 2 Red
9	Channel 10 Red	19	Channel 1 Red
10	Channel 11 Red	20	Red Enable

Provide a DB-9 female connector for the purpose of data communication with the controller. Electrically isolate the port interface electronics from all monitor electronics, excluding Chassis Ground. Furnish a communications connecting cable with pin connections as follows:

170		Conflict Monitor DB-9
RX pin L	Connect to	TX pin 2
TX pin K	Connect to	RX pin 3
+5 pin D	Connect to	DTR pin 4
GND pin N	Connect to	GND pin 5

2070L		Conflict Monitor DB-9
DCD pin 1	Connect to	DCD pin 1
RX pin 2	Connect to	TX pin 2
TX pin 3	Connect to	RX pin 3
GND pin 5	Connect to	GND pin 5
RTS pin 7	Connect to	CTS pin 7
CTS pin 8	Connect to	RTS pin 8

6.4. MATERIALS – TYPE 170 DETECTOR SENSOR UNITS

Furnish detector sensor units that comply with Chapter 5, "General Requirements for Detector Sensor Units," of the CALTRANS Specifications, and the requirements for Model 222 and Model 224 loop detector sensor units.

will operate properly even on a loop system that has a single-point short to earth ground.

6.5. MEASUREMENT AND PAYMENT

Actual number of metal strain signal poles without regard to height or load capacity furnished, installed and accepted.

Actual number of fully loaded controllers with cabinet (Type 170E, Base Mounted) furnished, installed, and accepted.

Actual number of fully loaded controllers with cabinet (Type 170E, Pole Mounted) furnished, installed, and accepted.

Payment will be made under:

Controller with Fully Loaded Cabinet (Type 170E, Base Mounted).....Each
Controller with Fully Loaded Cabinet (Type 170E, Pole Mounted).....Each

7. LIGHT STANDARD LUMINAIRES

7.1. DESCRIPTION

Furnish, install, and place into satisfactory operation, luminaires on the bracket arm complete with all lamps, ballasts, wiring inside standard from circuit conductors to luminaire, in-line fuses, ground rod, and ground wiring at the pole on light standards less than 75' in height.

7.2. MATERIALS

Use luminaires which are ellipsoidal shaped with a center of gravity not more than 18" from the end of the luminaire support, do not weigh more than 55 lbs., and have a maximum effective projected area of 1.2 square feet. Use luminaires that are UL listed and labeled. Use luminaires which have a refractor holder latch on the street side, ballast, starter, and capacitors mounted on a removable door, a slip fitter for 2" mounting brackets, and a socket adjustable in both vertical and horizontal directions capable of producing light in conformance with the specified IES distribution classification. Use a heat resistant glass prismatic heat refractor. Use luminaires that have an internal high power factor ballast of the regulated type, capable of operating from a multi-wire circuit and energize a high intensity discharge lamp. Have these lamps operate satisfactorily with a line voltage variation of ±10%. Provide a ballast pre-wired to the lamp socket and terminal board, requiring only the connection of the power supply leads to the terminal board.
Use luminaires with a wattage rating, voltage rating, lamp type, and light distribution as indicated on the plans.

Luminaire should be approved by the City prior to ordering and installing the luminaire to ensure compatibility with city code.

7.3. CONSTRUCTION METHODS

Date lamps with a code on the base and install just prior to the system being ready for testing. Level luminaires using leveling pads on the luminaire enclosure. Adjust any luminaires, as directed, to give optimum illumination distribution. The contractor shall install luminaires in the NW, NE and SE quadrants of the intersection according to note 14 on the plan set.

7.4. MEASUREMENT AND PAYMENT

Actual number of light standard luminaires and mastarms furnished, installed, and accepted.

Payment will be made under:

Light Standard Luminaire (250W, Cobra Roadway Series 325).....Each

8. REMOVAL OF EXISTING TRAFFIC SIGNAL INSTALLATIONS

8.1. DESCRIPTION

Remove existing traffic signal installations.

8.2. CONSTRUCTION METHODS

A. General:

Remove existing traffic signal installations at the following locations:

SR 1322 (Broad Street) at Perry Street ..... (05-2285)
SR 1407 (Carver Street) at Stadium Drive ..... (05-2291)

Maintain and repair traffic signal equipment within the limits of the project until the traffic signal equipment is disconnected and completely turned over to City of Durham Department of Transportation Signal Shop.

B. Removal:

Dismantle and remove existing traffic signal equipment and material, excluding joint use poles. Disconnect and remove all Department equipment from joint use poles in a manner that will not damage the poles or existing utilities and return fully operational equipment to City of Durham Department of Transportation Signal Shop unless otherwise directed by the Engineer. Cut electrical conduit and remove to at least 18 inches below finished ground elevation unless otherwise directed by the Engineer.

Install the required regulatory signs in accordance with Sections 900, 901, and 903 of the *Standard Specifications* before deactivating the traffic signal installation. Cover the signs with burlap bags until the traffic signal is put into flashing operation.

Place the traffic signal installation into flashing operation and immediately uncover the signs. Operate in flash mode for a minimum of one week.

Deactivate, dismantle, and remove the traffic signal installation after the one-week period unless otherwise directed by the Engineer.

Use methods to remove the traffic signal installation that will not result in damage to other portions of the project or facility. Repair damage that results from the Contractor's actions at no additional cost to the Department.

Final acceptance of the project is contingent upon the removal of the existing traffic signal installation. Removal of the existing traffic signal is part of the work required by the final completion date.

C. Disposal:

Remove all Department traffic signal equipment, span poles, messenger cable, interconnect cable, and supporting hardware that will not be reused. Assume ownership and promptly transport the removed poles, messenger cable, interconnect cable, and supporting hardware. Return all other traffic signal equipment and material to City of Durham Department of Transportation Signal Shop unless otherwise directed by the Engineer.

Return the removed equipment and material between the hours of 8:00 a.m. and 4:00 p.m. Monday through Thursday, or at a time mutually agreed upon by the Contractor and the Engineer. Replace or repair all material lost or damaged during its removal and transit. Label all returned equipment and material to indicate its original location.

8.3. MEASUREMENT AND PAYMENT

Payment is based the number of intersections completely cleared of all traffic signal equipment. The traffic signal equipment shall have existed along the roadway before the start of construction on the project, shall have had no changes made to the phasing or timing by the Contractor, shall have had no additional equipment installed by the Contractor during the life of the project (excluding equipment for maintenance), and shall have been removed as a part of the project.

Payment will be made under:

Traffic Signal Removal.....Each

9. NOTEBOOK COMPUTER

9.1. DESCRIPTION

Furnish a laptop computer to the City within 30 days of notice to proceed. The notebook computer shall meet or exceed the following specifications.

9.2. MATERIALS

A. Notebook Computer:

Provide a notebook computer with current Windows operating system with the following minimum features:

- Durabilty in accordance with MIL-STD-810F test procedures
- Processor clock speed : Pentium M 2.0GHz or AMD Turion64 2.0GHz or Core 2 Duo 2.0 Ghz
- 2GB MB of RAM expandable to 16 GB of RAM
- 15 inch TFT display, with video card having 256MB
- 80 GB hard disk
- One 2GB flash/jump USB device
- One combo CD Burner/DVD Drive Internal
- One parallel port, or USB to Parallel adapter
- One RS-232 serial port, or USB to Serial Adapter
- Four USB ports or USB type 2 travel type 4 port hub with one port onboard
- AC adapter/charger, and a car cigarette lighter adapter cable,
- Fully charged battery capable of a minimum of 2 hours of continuous operation,
- One spare battery,
- Sound card with built in speakers,
- Full function keyboard,
- Pointing device that is integral to the case (clip on devices will not be acceptable),
- One cable 10 feet long for connection to a controller port, (DB9 straight M&F serial cable)
- One cable 10 feet long for connection to network port on the workstation computer,

- Full screen source editing features,
- One on board modem that provides 56,600 bps for data and 14,400 bps for fax with RJ11 connector,
- 100Base TX (100 Mb/s Ethernet) with RJ-45 connector on board,
- IEEE 802.11g wireless network adapter on board
- Cushioned, soft-side carrying case.

Provide modems that comply with the following:

- Data Compatibility: V.34, V.FC, V.32, V.32bis, V.22, V.22bis, V.90, V.92
- Fax Compatibility: V.17, V.29, V.27ter
- Error Control and Data Compression: V.42/MNP 2-4 error control (hardware based), V.42bis/MNP 5 data compression (hardware based)
- Ethernet: IEEE 802.3

9.3. WARRANTY

Provide a minimum one-year warranty with notebook computer to ensure the products are free of manufacturing defects in material and workmanship. The warranty commences on the date the notebook computer is accepted by the Engineer.

9.4. MEASURMENT AND PAYMENT

Actual number of notebook computers furnished and accepted.

Payment will be made under:

Notebook Computer.....Each

10. AUTOMATED CONFLICT MONITOR TESTER

10.1. DESCRIPTION

Furnish an automated conflict monitor tester to the City within 30 days of Notice to Proceed. The automated conflict monitor tester shall be capable of automated testing of Conflict Monitor Units (CMU) as defined by NEMA TS1,NEMA TS2, FHWA/CalTrans System 170, and ODOT/TXDOT 2070 Standards and shall meet or exceed the following specifications.

10.2. MATERIALS

A. Automated Conflict Monitor Tester:

- Hardware and software to perform testing of CMUs when the proper cables are provided. Cables to be provided with this Tester are specified in these special provisions
- The Tester shall include Tester-to-CMU cables for the following CMU types (check boxes below):
  - o System 170: 16 channel
  - o System 2070: 16 channel
- The Tester shall require a Microsoft Windows-based computer (PC) to process the supervisory software during testing process
- The PC operating system must be Windows 2000, NT, XP or Vista and include a HTML browser

- The minimum PC hardware specification shall be Pentium (or equivalent) processor at 150 MHz, 32 MB RAM, 1.0 GB hard drive, 4X CDROM drive (for software installation), and 640 X 480 monitor resolution
- The supervisory software running on the PC shall provide the user interface for the Tester, allowing test setup, data entry, test report storage, retrieval, and review
- The supervisory software shall automatically sequence the Tester through the selected tests, accumulate results and assemble the test report
- The testing process shall proceed automatically after the initial test setup
- Visual confirmation of the CMU indicators may be required at the end of the test if applicable
- The user interface shall provide for selection of CMU standard, CMU type, manufacturer, model, and other information pertinent to the test via menus that list the available options for each selection
- The supervisory software shall automatically sense the PC port used by the Tester hardware
- The test report shall be stored on disk as an Adobe Acrobat PDF file at the conclusion of the test sequence
- The PDF file shall be viewed and printed using the free Adobe Acrobat Reader software
- The Acrobat Reader software can be downloaded at www.adobe.com. The Acrobat Reader should be at version 6.0 or higher in order for the test reports to display properly.
- The available test modes shall include Certification testing, Diagnostic testing, Single and Multiple-lap testing
- Diagnostic test groups shall include System/Timing tests, Conflict/Voltage tests, and Optional tests
- The Tester shall provide test voltages which are less than and greater than the proper voltage threshold limits, and determine if the CMU under test is in compliance with the appropriate standard
- The Tester shall be packaged in a 3U rack mount chassis
- A Tester carrying case with a pullout laptop shelf built to house the provided conflict monitor tester shall be provided for CMU field-testing
- Tester supervisory software shall be capable of creating and storing a test report detailing the nature and number of tests applied to the monitor
- The test report shall include; the start/stop time and date of the test, a listing of each test performed and the test result (PASS, FAIL). The report shall include operator-entered text for the name of the jurisdiction, agency, or firm that is responsible for the testing; the CMU under test by Manufacturer, Model, and Serial Number; the person performing the test, and the location where the tests were performed. Additional text fields for Device ID (30 characters), and comments or notes (110 characters) will be available. The test report shall form a self sufficient, easily understood document that can be interpreted without the use of separate instruction sets or code explanation tables.
- Multiple testers running simultaneous but independent tests can be controlled by one computer
- During actual testing, the controlling PC's display shall show the following information pertinent to the test in progress:
    - The monitor standard being used as the test basis
    - The make, model, type, and serial number of monitor being tested
    - The date and time of the beginning of the test

  - The Tester serial number and firmware version number
  - The test results of completed tests and title of the current test
  - The number of laps completed in the continuous testing mode
  - The number of tests failed
- The Tester shall perform the following pre-testing measures
  - Voltage self-test and timing self-test of the Tester to assure the accuracy of the test conditions and response measurement
  - Pre-test the CMU for the presence of incorrect return voltages that could damage the Tester
  - If these tests are not passed, the Tester shall alert the operator and halt the testing process
- The Tester shall include a Getting Started Guide describing all steps in the setup of the Tester as well as unlimited telephone technical support for the City of Durham
- The Tester shall provide extensive on-screen prompting and Help files and user manuals to extend ease of use to novice or infrequent operators
- The purchaser's interest in the Tester shall be protected by a one-year warranty on parts and labor
- The continuing utility of the Tester shall be further protected by the availability of repair, update, calibration, and extended warranty services from the manufacturer
- Software and Firmware updates for the tester shall be made available to download at no charge from the Manufacturer
- The tester must be have the ability to be calibrated

WARRANTY

Provide a minimum one-year warranty on parts and labor with automated conflict monitor tester to ensure the products are free of manufacturing defects in material and workmanship. The warranty commences on the date the notebook computer is accepted by the Engineer.

10.3. MEASURMENT AND PAYMENT

Actual number of automated conflict monitor testers furnished and accepted.

Payment will be made under:

Automated Conflict Monitor Tester.....Each

11. CONCRETE SIDEWALKS AND WHEELCHAIR RAMPS

11.1. DESCRIPTION.

The work covered by this section consists of the construction of portland cement concrete sidewalks and wheelchair ramps in accordance with the requirements shown on the plans and the provisions of these specifications.

11.2. MATERIALS.

All materials shall meet the requirements of Division 10 shown below:

Portland cement concrete ..... Section 1000
Curing agents ..... Section 1026
Joint fillers ..... Article 1028-1
Joint sealers ..... Article 1028-2

11.3. CONSTRUCTION REQUIREMENTS.

Where it is necessary to remove a portion of existing sidewalks or driveways, the Contractor will be required to furnish a neat edge along the pavement to be retained by sawing a neat line approximately 2 inches deep with a concrete saw before breaking the adjacent pavement away.

Concrete shall be constructed in accordance with Section 825 and shall be given a sidewalk finish, except as otherwise provided herein. Class B concrete shall be used.

Brooming of the concrete surface shall be done transverse to the direction of traffic. Joint spacing shall not be less than 5 feet. Where existing sidewalks are being widened, transverse joint shall be located so as to line up with existing joints in the adjacent sidewalk. Grooved joints shall not be sealed.

No backfill shall be placed adjacent to the sidewalk or wheelchair ramp until at least 3 curing days as defined in Article 825-9 have elapsed. However, backfill shall be placed no later than 4 calendar days after the completion of this 3 curing day time period. Backfill shall be compacted to a degree comparable to the adjacent undisturbed material.

11.4. METHOD OF MEASUREMENT.

The quantities of sidewalk, driveways, and wheelchair ramps to be paid for will be the actual number of square yards of sidewalks, driveways, and wheelchair ramps, measured along the surface of the completed work, which have been completed and accepted. In measuring these quantities, the length and width will be as called for on the plans or established by the Engineer.

11.5. MEASUREMENT AND PAYMENT.

The quantity of sidewalk, measured as provided in Article 848-4, will be paid for at the contract unit price per square yard for "Concrete Sidewalk (4")." The quantity of wheelchair ramps, measured as provided in Article 848-4, will be paid for at the contract unit price per square yard for "Concrete Wheelchair Ramps." Such prices and payments will be full compensation for all work covered by this section including but not limited to excavation and backfilling; sawing the existing sidewalk or driveway; furnishing and placing concrete; and construction joints.

Payment will be made under:

Concrete Sidewalk (4") ..... Square Yard
Concrete Wheelchair Ramps ..... Each

12. REMOVE EXISTING SIDEWALK OR CONCRETE SLAB

12.1. DESCRIPTION.

The work covered by this section consists of providing all labor, materials, tools, and equipment necessary for removing and disposing of existing concrete sidewalks, disposing of existing concrete slabs, or disposing of existing concrete curb and gutter as indicated on the Drawings or as directed by the ENGINEER.

12.2. MATERIALS.

NOT USED

12.3. CONSTRUCTION REQUIREMENTS.

1. Sidewalks, concrete slab, or curb and gutter, to be removed shall be separated from the remaining portion by saw cutting. Saw cuts shall be at right angles to the curb, sidewalk, or slab edge. Broken edges shall be trimmed to eliminate jagged or irregular surfaces. The CONTRACTOR shall dispose of the material at an approved disposal area.

2. The CONTRACTOR is responsible to secure disposal sites, including obtaining written permission from the owner and any required permits, if none are indicated on the Drawings or these Special Provisions. The cost of securing such sites shall be borne by the CONTRACTOR.

12.4. METHOD OF MEASUREMENT.

The quantities of removal of existing concrete sidewalks, removal of existing concrete slabs, or removal of existing concrete curb and gutter to be paid for will be the actual number of square yards of removal of existing concrete sidewalks, number of square yards of removal of existing concrete slab, or the actual number of linear feet of removal of existing concrete curb and gutter measured along the surface of the completed work which has been completed and accepted. In measuring these quantities, the length, depth and width must be approved by the Engineer.

12.5. MEASUREMENT AND PAYMENT.

The quantity of removal of existing concrete sidewalks will be paid for at the contract unit price per square yard for "removal of existing concrete sidewalks." The quantity of removal of existing concrete slabs will be paid for at the contract unit price per square yard for "removal of existing concrete slabs." The quantity of removal of existing curb and gutter will be paid for at the contract unit price per linear foot for "removal of existing curb and gutter." Such prices and payments will be full compensation for all work covered by this section including but not limited to excavation and backfilling.

Payment will be made under:

Removal of Concrete Sidewalks ..... Square Yard
Removal of Concrete Slab ..... Square Yard

13. REMOVE AND REPLACE EXISTING LANDSCAPING

13.1. DESCRIPTION.

The work covered by this section consists of providing all labor, materials, tools, and equipment necessary for removing and replacing existing landscaping as directed by the ENGINEER.

13.2. MATERIALS.

Materials used to replace existing landscaping must be of equal or greater value than existing landscaping materials

13.3. CONSTRUCTION REQUIREMENTS.

1. The species and age of the existing landscaping must be documented and presented to the ENGINEER in list form. Replacement materials must be of equal or greater value, and approved by

the ENGINEER and the PROPERTY OWNER. All Materials shall posses a 2 year warranty from date of installation.

2. The CONTRACTOR is responsible to secure disposal sites, including obtaining written permission from the owner and any required permits, if none are indicated on the Drawings or these Special Provisions. The cost of securing such sites shall be borne by the CONTRACTOR.

13.4. METHOD OF MEASUREMENT.

The quantities of removal and replacement of existing landscaping to be paid for will be Lump Sum following completion of installation and final acceptance.

13.5. MEASUREMENT AND PAYMENT.

The quantities of removal and replacement of existing landscaping to be paid for will be Lump Sum for "Landscaping." Such prices and payments will be full compensation for all work covered by this section including but not limited to excavation and backfilling.

Payment will be made under:

Landscaping.....Lump Sum

City of Durham Department of Transportation
BID FORM

DESCRIPTION: **Installation of Traffic Signals and Inductive Loops in Durham, NC**

CONTRACTOR: A L S of North Carolina, Inc.

ITEM	SECT	DESCRIPTION	UNIT	QTY.	UNIT PRICE	AMOUNT BID
1	200	SELECT TREE REMOVAL	EA	7	608.00	4,256.00
2	225	UNCLASSIFIED EXCAVATION	CY	50	38.40	1,920.00
3	226	GRADING	LS	1	4,135.00	4,135.00
4	846	2'6" CONCRETE CURB AND GUTTER	LF	75	40.50	3,037.50
5	1705	PEDESTRIAN SIGNAL HEAD (16", 1 SECTION W/ COUNTDOWN)	EA	14	663.00	9,282.00
6	1705	SIGNAL CABLE	LF	2700	1.80	4,860.00
7	1705	VEHICLE SIGNAL HEAD (12", 3 SECTION)	EA	14	776.00	10,864.00
8	1706	8" BACKPLATES	EA	14	63.00	882.00
9	1710	MESSENGER CABLE (3/8")	LF	1000	2.00	2,000.00
10	1715	DIRECTIONAL DRILL (2 CONDUITS-2")	LF	635	17.95	11,398.25
11	1715	TRACER WIRE	LF	100	0.75	75.00
12	1715	UNPAVED TRENCHING	LF	200	5.45	1,090.00
13	1716	JUNCTION BOX (OVER-SIZED, HEAVY DUTY)	EA	4	381.00	1,524.00
14	1716	JUNCTION BOX (STANDARD SIZE)	EA	8	216.00	1,728.00
15	1720	WOOD POLE	EA	2	624.00	1,248.00
16	1721	GUY ASSEMBLY	EA	2	262.00	524.00
17	1722	2" RISER WITH HEAT SHRINK TUBING	EA	1	317.00	317.00
18	1722	2" RISER WITH WEATHERHEAD	EA	2	381.00	762.00
19	1722	1" RISER WITH WEATHERHEAD	EA	2	214.00	428.00
20	1722	1/2" RISER WITH WEATHERHEAD	EA	1	167.00	167.00
21	1725	INDUCTIVE LOOP SAWCUT	LF	7600	4.80	36,480.00
22	1726	LEAD-IN CABLE (18-2 PAIR)	LF	1650	0.65	1,072.50
23	1730	COMMUNICATIONS CABLE (12 DROP FIBER)	LF	200	1.55	310.00

24	1730	COMMUNICATIONS CABLE (12 FIBER)	LF	1200	2.00	2,400.00
25	1731	FIBER-OPTIC TRANSCEIVER, FAULT TOLERANT	EA	1	1,595.00	1,595.00
26	1731	SPLICE ENCLOSURE	EA	1	2,373.00	2,373.00
27	1731	INNERCONNECT CENTER	EA	1	1,373.00	1,373.00
28	1743	SIGNAL PEDESTAL WITH FOUNDATION	EA	3	1,124.00	3,372.00
29	1750	SIGNAL CABINET FOUNDATION	EA	2	725.00	1,450.00
30	SD	PEDESTRIAN SIGNAL PUSHBUTTONPOST	EA	4	315.00	1,260.00
31	SD	50 AMP MANUAL TRANSFER SWITCH WITH EMERGENCY GENERATOR PROVISIONS	EA	2	721.00	1,442.00
32	SD	MODIFY EXISTING SPLICE ENCLOSURE	EA	1	1,040.00	1,040.00
33	SP	900MHZ WIRELESS RADIO STSYEM	EA	4	4,120.00	16,480.00
34	SP	900MHZ WIRELESS REPEATER STANDALONE RADIO SYSTEM	EA	1	7,574.00	7,574.00
35	SP	CONCRETE SIDEWALK 4"	SY	15	62.35	935.25
36	SP	CONCRETE WHEELCHAIR RAMPS	EA	4	1,478.00	5,912.00
37	SP	CONTROLLER WITH FULLY LOADED 336 CABINET (TYPE 170E, BASE MOUNTED WITH CABINET EXTENDER)	EA	1	9,444.00	9,444.00
38	SP	CONTROLLER WITH FULLY LOADED 332 CABINET (TYPE 170E, BASE MOUNTED)	EA	1	10,211.00	10,211.00
39	SP	LIGHT STANDARD LUMINAIRE (250W, COBRA ROADWAY SERIES 325)	EA	7	280.00	1,960.00
40	SP	TRAFFIC SIGNAL REMOVAL	EA	2	2,036.00	4,072.00
41	SP	DRILLED PIER FOUNDATION	CY	24	769.00	18,456.00
42	SP	MASTARM WITH METAL POLE DESIGN	EA	4	601.00	2,404.00
43	SP	METAL POLE WITH DUAL MASTARM	EA	3	14,869.00	44,607.00
44	SP	METAL POLE WITH SINGLE MASTARM	EA	1	8,598.00	8,598.00
45	SP	MODIFY ELECRICAL SERVICE	EA	2	452.00	904.00
46	SP	NEW ELECRICAL SERVICE	EA	4	890.00	3,560.00
47	SP	REMOVAL OF CONCRETE SIDEWALK	SY	22	80.75	1,776.50
48	SP	REMOVAL OF CONCRETE SLAB	SY	2	87.50	175.00
49	SP	REMOVAL OF CURB AND GUTTER	LF	75	33.90	2,542.50
50	SP	SOIL TEST	EA	4	1,184.00	4,736.00
51	SP	NOTEBOOK COMPUTER	EA	2	3,651.00	7,302.00
52	SP	CONFLICT MONITOR TESTER	EA	1	16,140.00	16,140.00
53	SP	LANDSCAPING	LS	1	1,256.00	1,256.00

TOTAL BID FOR PROJECT: 283,710.50

CONTRACTOR ALS of North Carolina, Inc

ADDRESS PO Box 2949 Fayetteville, NC 28302

Federal Identification Number 56-1482029 Contractors License Number 18772-U

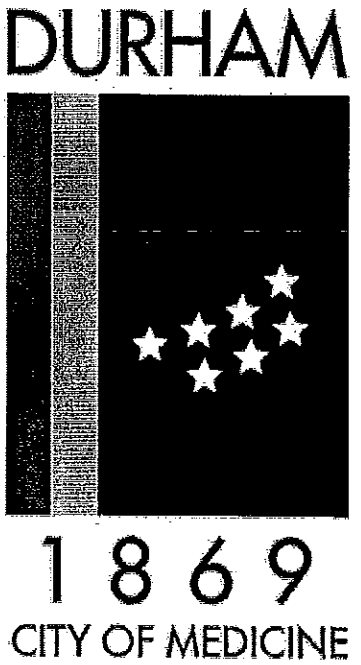
Authorized Agent James B. Hardiman Title Vice President

Signature _____ Date 11/17/10

Witness Amy Sawicki Title Contract Admin.

Signature Amy Sawicki Date 11/17/10

APPENDIX A



Submittal Checklist and Timeline for Project Events

CONTRACT: Installation of Traffic Signals and Inductive Loops in Durham, NC

Installation of a Traffic Signals Broad at Perry, Stadium at Carver and Inductive Loops in Durham

Submittal Checklist

Included? (Please Initial)	Name or description of form	Necessary to submit this form?	When to submit it?
[signature]	Completed Bid Form	Yes	With the bid
AS	Non-Collusion Affidavit for all Subcontractors	Yes	With the bid
AJ	Copy of City of Durham Privilege License	Yes	With the bid
AS	Proof of Insurance	Yes	With the bid
AL	Your Company's Equal Employment Opportunity Statement	Yes	With the bid

NON-COLLUSION AFFIDAVIT, DEBARMENT CERTIFICATION AND GIFT BAN CERTIFICATION

CORPORATION

The prequalified bidder being duly sworn, solemnly swears (or affirms) that neither he, nor any official, agent or employee has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, and that the prequalified bidder intends to do the work with his own bonafide employees or subcontractors and will not bid for the benefit of another contractor.

By submitting this non-collusion affidavit, the Contractor is certifying his status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. § 133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF PREQUALIFIED BIDDER

A.L.E. of North Carolina, Inc.
Full name of Corporation

Post Office Box 2949, Fayetteville, North Carolina 28302
Address as Prequalified

Attest [signature] By [signature]

Secretary/Assistant Secretary — *Select appropriate title*

~~President~~/Vice President/~~Assistant Vice President~~ — *Select appropriate title*

Pamela Jukowski
Print or type Signer's name

James R. Hackman
Print or type Signer's name

CORPORATE SEAL

AFFIDAVIT MUST BE NOTARIZED

Subscribed and sworn to before me this the
17 day of November 2010
Amy Lynn Sawicki
Signature of Notary Public
of Cumberland County
State of North Carolina
My Commission Expires: April 7, 2013

AMY LYNN SAWICKI NOTARY PUBLIC CUMBERLAND COUNTY, N.C.

NOTARY SEAL

Licenses

Ordinance	Description	Units	Rate	Amount
64	CONTR:ELECTRICAL	1	$ 50.00	$ 50.00

Total: $ 50.00

Receipt

Receipt ID:	99498
Date:	06-24-2010
Time:	
Rcvd By:	Gloriad
Reg:	1
Dwr:	
Pymt No:	89583
Type:	Check
Chk No:	02640816
Amt Rcvd:	$ 50.00
Tax:	$ 50.00
Change:	$ 0.00

City of Durham

Privilege License

FILE COPY

ALS of North Carolina , Inc
708 Blair Mill Rd, Attn: Tax Dept
Willow Grove, PA 19090

page 1 of 1

Account No	Date Issued	Tax Year Beginning	Tax Year Ending
22093	06/24/2010	07-01-2010	06-30-2011

City of Durham Privilege License

2011

Ordinance	Description	Units
64	CONTR:ELECTRICAL	1

DURHAM

ALS of North Carolina , Inc
Business Address: 1515 Wilmington HWY

Licenses must comply with all local ordinances or the license may be forfeited.
This license must be posted conspicuously where business is conducted.

ALS of North Carolina , Inc
708 Blair Mill Rd, Attn: Tax Dept
Willow Grove, PA 19090

Issued By: City Collector of Revenue

page 1 of 1

Account No	Date Issued	Tax Year Beginning	Tax Year Ending	Receipt No
22093	06/24/2010	07-01-2010	06-30-2011	99498

Licenses

Ordinance	Description	Units	Rate	Amount
64	CONTR:ELECTRICAL	1	$ 50.00	$ 50.00

Total: $ 50.00

Receipt

Receipt ID:	99498
Date:	06-24-2010
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Rcvd By:	Gloriad
Reg:	1
Dwr:	
Pymt No:	89583
Type:	Check
Chk No:	02640816
Amt Rcvd:	$ 50.00
Tax:	$ 50.00
Change:	$ 0.00

City of Durham

Privilege License

RECEIPT

ALS of North Carolina , Inc
708 Blair Mill Rd, Attn: Tax Dept
Willow Grove, PA 19090

page 1 of 1

Account No	Date Issued	Tax Year Beginning	Tax Year Ending
22093	06/24/2010	07-01-2010	06-30-2011

Installation of a Traffic Signals Broad at Perry, Stadium at Carver and Inductive Loops in Durham		
Timeline of Events		
	Beginning	Ending
Contract Available: (4th Floor Transportation Division of City Hall 8 AM until 5 PM, Monday through Friday)	Monday, 11/1/2010	Monday, 11/22/2010
Prebid Meeting: (City Hall 4th Floor Transportation Conference Room)	Wednesday, 11/10/2010 2:00:00 PM	
Bid Opening: (City Hall 4th Floor Transportation Conference Room)	Monday, 11/22/2010 2:00:00 PM	
Date of Availability:	(To Be Determined)	
Notice to Proceed:	(To Be Determined)	
Pre-Construct. Meeting: (Call 919-560-4366 for Location)	(To Be Determined)	
Completion Date:	The lesser of 30 calendar days after delivery of Mastarms or 8 months after notice to proceed.	

APPENDIX B

DURHAM

1869

CITY OF MEDICINE

SDBE Participation Goals

CONTRACT: Installation of Traffic Signals and Inductive Loops in Durham, NC

SMALL DISADVANTAGED BUSINESS ENTERPRISE

REQUIREMENTS

CITY OF DURHAM, NC

PROJECT GOAL SHEET FOR;

Installation of Traffic Signals and Inductive Loops in Durham, NC

GENERAL CONSTRUCTION

SDBE

0%

October 20, 2010

Memo To: Mark Ahrendsen, Transportation Director
Department of Transportaion

From: Deborah Giles, Director
Equal Opportunity/Equity Assurance

Subject: Broad, Perry & Stadium Carver Traffic Signal Construction Project

The Equal Opportunity/Equity Assurance Department reviewed the specifications submitted for the above-referenced project to determine appropriate SDBE participation goals.

MSDBE Participation Goal

Based on the specifications outlined for this project, the MSDBE participation goal should be 0%.

WSDBE Participation Goal

Based on the specifications outlined for this project, the WSDBE participation goal should be 0%.

cc: Pete Nicholas, Project Manager

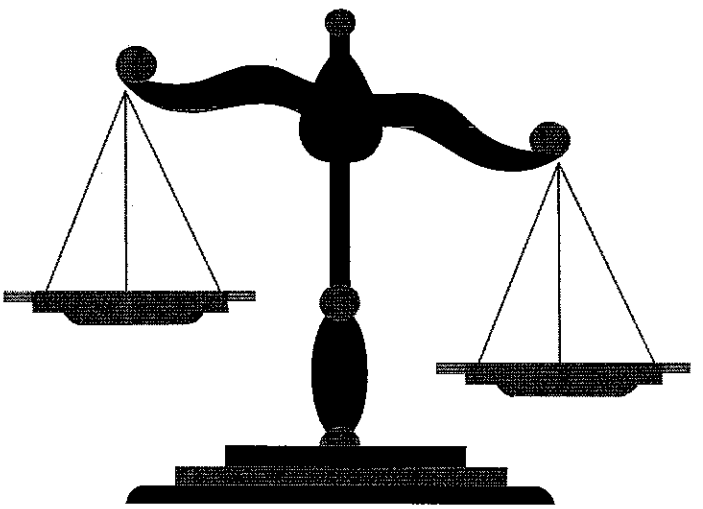
DVL

DURHAM
1869
CITY OF MEDICINE

CITY OF DURHAM
SMALL DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

PROCUREMENT FORMS

Revised 06/08



Mailing Address:

101 City Hall Plaza
Durham, North Carolina 27701
Phone: 919-560-4180
Facsimile: 919-560-4513

Street Address:

302 East Pettigrew Street, C-180
Durham, North Carolina 27701

The Department of Equal Opportunity/Equity Assurance

Good Things Are Happening In Durham

COMPLETE THIS FORM
DECLARATION OF PERFORMANCE BY VENDOR/CONTRACTOR

Briefly address each of the following items:

1. A brief synopsis of the company and the products/services it provides:
   ALS of North Carolina, Inc is located in Fayetteville, NC. ALS is a private company categorized as a Lighting Contractor and specializes in Traffic Signal Installations.

2. Describe the normal procedure used on a bid of this type, giving the flow of purchase from the company to the ultimate purchaser:
   Contract Execution
   Selection of subcontractors and Subcontract Execution
   Pre-Construction meeting
   Material Submittals
   Project Construction
   Observation Period
   Project Acceptance

3. List anyone outside of your company with whom you will contract on this bid:
   Subcontractors have not been identified on this contract

The undersigned vendor/contractor certifies that:

(a) It is normal business practice of the vendor/contractor to perform all elements of the contract with its own work force without the use of subcontractors/vendors; and

(b) That the above documentation demonstrates this firm's capabilities to perform all elements of the contract with its own work force or without the use of subcontractors/vendors.

11/24/2010
Date

Amy Sawicki
Authorized Signature

COMPLETE THIS FORM
Managerial Profile

Name of Firm: ALS of North Carolina

Contact person: Amy Sawiki

Title: Manager

Address: 1515 Wilmington Hwy P.O. Box 2949 Fayetteville, NC 28302

Telephone No.: (910) 483-9100

Date: 11/17/10

List the managerial persons in your work force who will be participating in this project, including name, position, and whether the individuals are minority or woman within the definition* of the City of Durham's Minority and Women Business Enterprises Ordinance.

Managerial Employees

NAME	POSITION	(YES/NO) MINORITY/WOMAN
See Next sheet		

*"Minority" means an individual who is a citizen or lawful permanent resident of the United States and who is a "Black American", a person having origins in any of the Black racial groups of Africa. On building contracts, construction over $100,000.00 or federally funded projects, the federal and/or state definitions apply.

1515 Wilmington Hwy. (28306)
P.O. Box 2949 Fayetteville, North Carolina 28302
Phone: (910) 483-9100 / Fax: (910) 483-8137

Supervisor and Foreman listing

Supervisor

Claude Zukowski
Steve Balmer

General Foreman

Cliff Reinoehl
Patrick Reinoehl
Scott Carter
Alan Hoffman

of North Carolina, Inc.

1515 Wilmington Hwy. (28306)
P.O. Box 2949/Fayetteville, NC 28302
Phone: (910) 483-9100 / Fax: (910) 483-8137

November 1, 2009

MEMORANDUM

To: **All Employees**

Subject: **Company Policy – Equal Employment Opportunities**

Our Company has every intention of continuing compliance with Title VII of the Civil Rights Act and with the terms of the President's Executive Orders 11246 and 11375 on Equal Employment Opportunity. There shall be no discrimination against any employee or applicant because of race, color, religion, sex, national origin, disability, or veteran status. We subscribe to the policy and our Program of Affirmative Action that all employees will be treated the same during their employment in all matters, including hiring, upgrading, promotion, transfer, layoff, termination, rates of pay, selection for training, or recruitment. The full cooperation of all employees and all levels of supervision is expected.

James Hardiman
Field Manager

Sallie Theis
EEO Officer

ALS of North Carolina, Inc.

1515 Wilmington Hwy. (28306)
P.O. Box 2949/Fayetteville, NC 28302
Phone: (910) 483-9100 / Fax: (910) 483-8137

NOVEMBER 1, 2009

It is the policy of ALS of North Carolina, Inc. to continue to provide equal employment opportunity to disabled persons through employment and advancement in employment and to otherwise treat qualified individuals without discrimination based upon their physical or mental disabilities. Such action shall apply to our employment practices, including hiring, upgrading, demotion or transfer, recruitment, recruitment advertising and job application procedures, layoff or termination, rates of pay or other forms of compensation, job assignment, job classifications, organizational structures, position descriptions, leaves of absence, sick leave or other leave, selection for training, including apprenticeship, professional meetings, conferences, and other related activities and activities sponsored by the Company including social or recreational programs, and any other term, condition, or privilege of employment. Employees or applicants shall not be subjected to harassment, intimidation, threats, coercion, or discrimination because they have engaged in or may engage in a activities such as filing a complaint, assisting, or participating in an investigation, compliance review, hearing, or any other related activities associated with the administration of Section 503 of the Rehabilitation Act of 1973, as amended or any other federal, state, or local law requiring equal opportunity for disabled persons or for opposing any act or practice made unlawful by Section 503 or its implementing regulations in this part.

The Field Manager has the responsibility for ensuring full compliance with the provisions of Section 503 of the Rehabilitation Act of 1973 and other applicable directives. Responsibility for implementation and monitoring of these programs and actions are assigned to our EEO Officer who serves as our Equal Opportunity Coordinator. Our program for individuals with disabilities is available upon request on regularly scheduled workdays by advance appointment with our Equal Opportunity Coordinator.

We reaffirm the above basic policy with respect to disabled employees. Reasonable attempts will be made to appropriately accommodate limitations of disabled workers, taking into account business necessity, financial cost, and expenses. We expect to engage in a continued program of outreach and seek to recruit persons with disabilities who are qualified to perform the work we do here.

James Hardiman
Field Manager

Sallie V. Theis
EEO Officer

COMPLETE THIS FORM OR ATTACH COMPUTERIZE FORM

EMPLOYEE BREAKDOWN

Part A – Employee Statistics for the Primary Location

M-------a-------l-------e-------s F-----e-----m-----a-----l-----e-----s

Employment Category	Total Employees	Total Males	Total Females	White	Black	Hispanic	Asian or Alaskan Islander	Indian or Alaskan Native	White	Black	Hispanic	Asian or Pacific Islander	Indian or Alaskan Native
Project Manger	1	1		1									
Professional													
Labor	8	7	1	8									
Clerical													
Totals	9	8	1	9									

Part B – Employee Statistics for the Consolidated Company (See instructions for this form on whether this part is required.)

M-------a-------l-------e-------s F-----e-----m-----a-----l-----e-----s

Employment Category	Total Employees	Total Males	Total Females	White	Black	Hispanic	Asian or Alaskan Islander	Indian or Alaskan Native	White	Black	Hispanic	Asian or Pacific Islander	Indian or Alaskan Native
Project Manger													
Professional													
Labor													
Clerical													
Totals													

APPENDIX C

DURHAM

1869

CITY OF MEDICINE

LISTING OF SDBE SUBCONTRACTORS

CONTRACT: Installation of Traffic Signals and Inductive Loops in Durham, NC

SDBE Listing for Broad, Perry Stadium Carver Traffic Signal Construction Project

Name	Mailing Address	City	State	Zipcode	Gender/Race ID	Contact	Phone	Fax	CellPhone	Email	Services	Licenses
ADIA of NC, LLC	1605 Holloway St., # D	Durham	NC	27703-1456	M	Andrew Bishop, Jr.	919-801-3403	919-667-1456	919-801-3403	adia_inc@yahoo.com	Lawn Care; Cutting, landscaping, Fencing, Tree Removal, Demolition, Hauling, Clearing	City of Durham Business license
AMH-ELOHIM Enterprise, LLC	5712 Brookshadow Drive	Raleigh	NC	27610	M	Antwone Hunt	919-255-9829	919-255-9829		ahunt@amhee.com	concrete work, place and finish, repair and restoration	
Andre Laws Grading & Backhoe Service, Inc.	1306 Broad Street	Durham	NC	27705	M	Andre Laws	919-641-5641	919-416-1131	919-427-2583	callis3@verizon.net	Grading, Clearing and Excavation	City of Durham Business License
Ardnek Footings, Inc.	409 Arborhill Lane	Holly Springs	NC	27540	M	Kenneth Cole	919-303-4600	919-303-4607	919-730-1417	ardnekfootings@nc.rr.com	Concrete, Footings	
Atlantic Contracting Co., Inc.	PO Box 49559	Greensboro	NC	27419	W	Niveen Kattan	336-931-3109	336-931-3108		info@atlanticcontractinginc.com	Concrete Masonry	NC General Contractors License
B & A Concrete Masonry	190 Alyssum Drive	Four Oaks	NC	27524	M	Billy Giles	919-427-8048		919-427-3966	angiles@ncac.edu	concrete; masonry; curb and gutter; sidewalks; handicap ramps	City of Durham Business License
B & B Triangle Landscaping and Irrigation, Inc.	PO Box 25006	Durham	NC	27702	M	Andre Bond; Byron Fletcher	919-384-9300	919-384-9300	919-412-3718	abond@bandbtrianglelawncare.com	landscaping;Lawn maintenance;cleaning;construction cleanup; snow removal	City of Durham Privilege License
BD & J Services, LLC	600 S. Magnolia Ave.	Dunn	NC	28334	M	Brenda Haywood	910-892-2884	910-892-8775	910-308-6346	woodyl1059@aol.com	waste disposal; demolition; grounds maintenance; sludge removal; demolition; litter pickup; landscaping	
Buffalo Creek Grading & Transport, Inc.	PO Box 685	Wendell	NC	27591	W	Melissa Morgan	919-266-7473	919-365-3655	919-266-7473	wrennronnie@yahoo.com	hauling; grading; landscaping; construction; excavation; dozer work	
Bullock Building Company, Inc.	1012 Carpenter Fletcher Rd.	Durham	NC	27713	M	Stephanie Alston	919-544-8381	919-544-5532		stephanie@bullockbuilding.com	concrete, metal stud, drywall	City of Durham Privilege
Busy Black Trucking, LLC	406 W. Carver St.	Durham	NC	27704	M	Anthony Black	919-442-7079	919-471-6232	919-442-7079	busyblacktrucking@nc.rr.com	hauling services-all aggregate materials, rock, sand, dirt, concrete debris, demolition	City of Durham Privilege
C & L Turf Works, Inc.	1405-A Old Oxford Highway	Durham	NC	27704	M	Charles Swann	919-730-2258	919-477-7487		clturfworks@aol.com	grading; excavation; land clearing; hauling;demolition; backhoe services	City of Durham Privilege License

Caldwell Properties, LLC	202 Wenonah Way	Durham	NC	27713	M	Percy Caldwell	919-544-4127	919-544-2442	919-225-4164	cpercycc@aol.com	drywal,concrete,framing,masonry,tiling, woodwork,general construction	NC General Contracting License#66047 Limited Building;City of Durham
Certified Concrete Construction, Inc.	PO Box 545	Morrisville	NC	27560	W	Joel Sousa	919-481-6700	919-481-9058	919-442-8358	ccconstruction@bellsouth.net	concrete flat work; curb & gutter; sidewalk; concrete paving; dumpster pads; wheelchair ramps; driveways	City of Durham Privilege License
City Wide Construction Company	7943 Halyard Terrace	Chesterfield,	VA	23832	M	Tonya Belfield; Carlton Belfield	804-339-0839	804-639-7224		tbelfield@verizon.net	Demolition, hauling, excavation, paving, grading, landscaping	Class A Contractor"s License-VA
Complete Lawn Care	5853 Sandstone Drive	Durham	NC	27713	M	Robert Grimsley	919-544-7603	919-544-7131	919-201-9646	completelawncare44@yahoo.com	Landscaping; lawncare; hauling topsoil, gravel and sand	City of Durham Business license
Core Master, LLC	PO Box 8946	Rocky Mount	NC	27804	M	Lisa Gonzalez	252-451-5661	252-451-5662	252-205-3386	info@coremasterusa.com	concrete core drilling; floor/wall/hand sawing; controlled demolition	
Cruz Brothers Concrete, Inc.	1572 Payne Road, #75	Graham	NC	27253	H	Maria I. Cruz	336-376-0787	336-376-1115	336-516-5764	ines@cruzbros.com	Concrete curb & gutter, sidewalks, slabs, driveways	
Davidson Construction, LLC	208 Gibson Lane	Clayton	NC	27520	M	Tony Small	919-550-3485	919-550-3485	919-868-7771	davidsonbldg@aol.com	concrete; demolition; sheerock; metal studs; construction	NC General Contracting#63308 Limited Building
Double R Concrete Finishing	6917 Windover Drive	Durham	NC	27712	M	Randy Williams	919-477-3009	919-477-3009	919-624-3009	doubleconcretefinishing@verizon.com	grading; hauling; concrete placement: grading, forming , pouring &finishing	City of Durham Privilege
Earth Reformers, Inc.	PO Box 11678	Durham	NC	27703	M	Kirk Bradsher, Jr., Tasha D. Bradsher	919-596-9361	919-596-0592	919-422-0443	earthreformer@aol.com	Grading & Hauling	Durham Business License;NC Gen. Contractors Lic. Highway (Grading & Excavting) Limited
ECON International Corporation	1709 Fruehauf Drive, Suite 206	Charlotte	NC	28273	H	Albeiro Loaiza	704-688-3709	704-688-7488	704-309-8052	econico@aol.net	concrete; curb & gutter;masonry;pavers; asphalt; traffic control erosion control	NC General Contractor's License#54374; City of Charlotte
ETC Concrete Construction Corporation	3829 Opportunity Lane	Raleigh	NC	27603	H	Liz Esteves	919-772-4114	919-772-4174	919-291-5719	liz@etcconcrete.com	concrete-sidewalks,paving,footings	
Hine Sitework, Inc.	PO Box 1275	Goldsboro, NC	NC	27533	W	Ann Hine	919-736-8990	919-736-8886	919-738-2972	ann@hinesitework.com	demolition; grading; paving; concrete; erosion control;clearing&grubbing; water& sewer curb&gutter;storm drainage	NC General Contracting#52225 Unlimited:Higway, PU (Water & Sewer)

Holmes Contracting, Inc.	PO Box 1038	Cary	NC	27512	M	Henry Hardy	919-851-5897	919-851-0297	919-422-9390	holmescontractin@bellsouth.net	General Contracting (Highway, Building); Street Constuction; Site Development; Commercial Building Contracting; Greenways; Grading	General Contracting Unclassified(U) No. 34222
Honducom Concrete, Inc.	PO Box 14968	Raleigh	NC	27620	H	Ramon Suazo	919-662-0388	919-662-0390	honduconconcrete@earthlink.net	919-796-7148	concrete work-commercial, residential and industrial	City of Raleigh Privilege License
Hughes Masonry	2524 Hwy 55	Durham	NC	27713	M	Billy Hughes	919-201-2498	919-403-9643	919-201-9138	bhughes.masonry@yahoo.com	masonry; brick; stone work; pressure washing;concrete	City of Durham Privilege License
ICORE Service Company, LLC	4216-A Queen Beth Drive	Greensboro	NC	27405	M	Cornelius Lamberth	336-274-2394	336-617-8253	336-362-1646	rhlamb@hotmail.com	Framing, Ceilings, Concrete (Flat), Doors and Hardware	NC General Contractor's License - Building, Limited
IQ Contracting, LLC	PO Box 6069	Raleigh	NC	27628	H	Robert A. Nunez	919-832-5111	919-832-4111	919-616-2618	rnunez@iqcontracting.net	Concrete Construction and Concrete Repair	City of Raleigh Privilege License
J.A. Farrington Janitorial Services, Inc.	2403 Fayetteville St.	Durham	NC	27707	M	James Farrington	919-308-7988	919-806-8064	919-308-7988	kemetuniversal@hotmasil.com	Janitorial Services and cleaning; landscaping & ground maintenance; irrigation; snow removal	Durham Privilege License
Kearneco Grading	1512 US Hwy 401 S.	Warrenton	NC	27589	M	Paul Kearney	252-257-4106	252-257-9411	252-213-1932	pkearney@ncol.net	grading;excavation;demolition	
Kinston Contracting, Inc.	113 East Gordon Street	Kinston	NC	28501	M	Linda J. Lanier	252-268-7768			dirtplay21@yahoo.com	general construction;grading; clearing;concrete;landscaping	
KMC Development, Inc.	3632 Singleleaf Lane	Raleigh	NC	27616	W	Kristina Carter	919-266-0216	919-266-0216	919-215-3774	kmcartertws@bellsouth.net	Installing pump stations, wholesale supplier of iron pipes & concrete structures.	
Lanier Construction	1505 Browntown Road	Snow Hill	NC	28580	M	Sherba Lanier	252-747-8124	252-747-4337	255-286-6735	henry@lanierconstructionco.com	Curb & Gutter, Concrete, Grading, Road Construcion, General construction	
Martinez Company, Inc.	342 Fleming Drive	Durham	NC	27712	H	Keith Brown, Luis Martinez Guerrero	919-255-8817	336-282-7600	919-724-2611	luis342@bellsouth.net	demolition; concrete cutting/repair/placement/slabs/sidewalks;waterproofing; grouting; caulking; sealers; sandblasting; pressure washing; erection of prsut; natural stone	
Mayo's Masonry, Inc.	4917 Howe Street	Durham	NC	27704	M	Phillip Mayo	919-730-5053	919-237-3105	919-730-5053	mayo_masonryinc@yahoo.com	Concrete/Masonry	

McClure and Associates Construction, Inc.	6201 Remington Lake Drive	Raleigh	NC	27615	W	Lesle McClure	919-878-8006	919-878-7992	919-868-3649	Lesle@mcclurebuilders.com	new commercial and residential construction; commercial and residential renovation/rehab; painting; grading; demolition; drywall; concrete; framing; roofing; metal roofing;	NC General Contractors License#42632 Unlimited Building
New Beginning Landscape, LLC	11438 Larix Drive	Charlotte	NC	28273	M	George Daniels	704-400-4930	704-504-3115	704-508-4930	gdaniels@carolina.rr.com	Landscaping	
Norlina Grading & Excavating, LLC	P.O. Box 1092	Norlina	NC	27563	W	Wilma Snyder	252-456-2002	252-456-2002	252-432-2112	wilma_snyder@yahoo.com	public utilities-water, sewer, drain, grading; excavating & land clearing	
Owens Landscaping and Concrete Service	822 Midland Terrace	Durham	NC	27704	M	James Owens	919-596-0775	919-956-8059	919-618-5698	owenscurtman@aol.com	Concrete/Landscaping	
P & J Contracting Co., Inc.	3010 Ridgewood Ave.	Baltimore	MD	21215	M	Pless B. Jones, Sr.	410-367-2475	410-367-4103	919-618-5698	pless.jones@pandjcontracting.com	demolition;hauling;excavation; site work; site demo; grading	NC General Contractor# 25409
Pro-Site Services, LLC	800 N. Mangum Street, Suite 200	Durham	NC	27701	M	Ronald Williams	919-667-9790	919-530-1770	919-730-8110	rwprosite@yahoo.com	Concrete Construction	City of Durham Business License
RDU Paving, Inc.	5415 Fayetteville Road	Raleigh	NC	27603	W	Jeanette Lundholm	919-329-7300	919-329-7301	919-625-2832	sales@rdupaving.com	asphalt paving; new pavement construction/repair;seal coating; striping; small concrete repair	City of Raleigh, NC General Contractors License - Highway, Limited: #62537
Reddrick Masonry	701 Felicia Street	Durham	NC	27704	M	Rueben Redrick	919-477-8297	919-620-0721	919-730-0983	reddrickmasonry@aol.com	hardscape brick paving; concrete; curbs; gutters; masonry; walk ways	City of Durham Privilege
RTP Grading & Sitework, LLC	PO Box 12537	Durham	NC	27709	M	Blair Peil	919-361-5400	919-361-5432	919-427-1215	rtpgrading@netzero.com	demolition, clearing, erosion control, concrete, grading, asphalt, water&sewer,curb&gutter, sidewalks, retentionponds/walls,stormdrain	City of Durham; Town of Chapel Hill
S & M Concrete Construction, LLC	10504 Lucasville Road	Manassas	VA	20112	H	Caroline Franklin; Jack Desa	703-392-9045	703-368-7421		smcc04@msn.com	concrete	VA Class
Sanchez Trucking	922 Riverbark Lane	Durham	NC	2703	H	Marcial Sanchez	919-697-9004	919-596-5402		trucking.sanchez@yahoo.com	hauling;concrete removal; sidewalks; driveways	City of Durham Privilege

Southern Garden, Inc.	P O Box 808	Apex	NC	27502	W	Todd Laakso	919-362-1050	919-363-9222	919-337-7615	info@southerngardeninc.com	Landscaping: Landscape Installation/ Maintenance; irrigation, seed & mulch; NC Pest Control Applicator; brick & unit pavers, light masonry; water features; playground equipment; parks; site furnishings & amenities; retaining walls; wetland plantings.	City of Durham Privilege License;NC Landscape Contractor #1049;NC Ground Pesticide Application
Stokes Landscaping	7826 Fawnbrook Drive	Hillsborough	NC	27278	M	Maurice Stokes	919-477-9591	919-321-6191	919-624-3939	srmosto@aol.com	Landscaping; Drainage Work; Grounds Maintenance; Grading	City of Durham Business License
Tarheel Asphalt & Seal Coating	4920-100 Capital Blvd.	Raleigh	NC	27616	M	Jerry Perry	919-779-0806	919-779-0806		jperry0401@att.net	asphalt paving, patching; seal coating; striping; grading; demolition	City of Raleigh
Traco Gypsum Flooring, Inc.	PO Box567	Oakridge	NC	27310	W	Tracy Cooke	336-643-9571;	336-644-1759		tracycooke@tracoconstruction.com	gypsum flooring; flashing and waterproofing; light weight concrete	
Triad Curb & Concrete, Inc.	3716 Mount Zion Church Road	Mebane	NC	27302	W	Sharon Bennett	336-578-0007	336-578-0006		twilson@triadcurb.com	concrete curb & gutter; sidewalk; paving; asphalt paving	
Triangle Landscape Supplies of JC, LLC		Garner	NC	27529	M	Stacey Mangum	919-553-1118	919-553-7161	919-274-2661	slmangum@nc.rr.com	Supplier of Landscaping Supplies	
W. E. Garrison Company, Inc.	5820 Fayetteville Rd.	Raleigh	NC	27603	W	Colleen B. Garrison	919-772-4144	919-772-4860	919-306-6158	colleeng@wegarrison.com	Hauling; Clearing; Grading; Concrete Curb & Gutter & Flatwork; Field Engineering; Demolition; Grubbing; Storm Drainage	N. C. General Contractors No. 4019
Wilson Lawn Service of Durham, Inc.	4608-O Industry Lane	Durham	NC	27713	M	Ernest Wilson	(919)572-9155	(919) 572-9153	(919) 730-6343	wilsonlawnofdurham@verizon.net	landscaping; lawn maintenance; mowing; clean-ups	City of Durham Privilege License